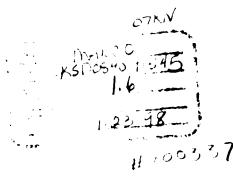
Golder Associates Inc.

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Prepared for:

Kansas Department of Health and Environment Forbes Field, Building 740 Topeka, Kansas 66620-0001

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Distribution:

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January 23, 1998

973-2300.7



KANSAS DEPARTMENT OF HEALTH & ENVIRONMENT

BILL GRAVES, GOVERNOR Gary R. Mitchell, Secretary

March 6, 1998

Janice Kroone, EPA OSC 1201 North Santa Fe Avenue Chanute, Kansas 66720

Subject:

Draft Report of Phase I Comprehensive Investigation of Contaminant Migration

Off-Site of the MARCO Site, Chanute, Kansas

Dear Ms. Kroone:

As we discussed by telephone I am furnishing you with a copy of a Draft Report of the Kansas Department of Health and Environment's (KDHE) Phase I Comprehensive Investigation of Off-Site Contaminant Migration of the MARCO Site, Chanute, Kansas. KDHE intends to accept the report as Final requiring no changes.

Mr. Randy March, representing Golder Associates, Inc., the contractor conducting the off-site investigation for KDHE, will be contacting you soon concerning access to the MARCO property for sampling purposes. Mr. March is Golder's project manager for this investigation and he wishes to discuss with you your requirements while he is sampling on MARCO property. I have advised him of the areas near the south and east property site borders in which his investigation will be confined to avoid EPA activities now taking place on the MARCO property.

If you have any questions please call me.

Sincerely,

Tom Peterson

Environmental Geologist

Voluttary Cleanup and State Water Plan Unit

Bureau of Environmental Remediation

(785) 296-5555

C: Susan Stover--> file

Golder Associates Inc.

200 Union Boulevard, Suite 500 Lakewood, CO USA 80228 Telephone (303) 980-0540 Fax (303) 985-2080



DRAFT REPORT ON PHASE I INVESTIGATION OF CONTAMINANT MIGRATION OFF-SITE OF THE MARCO SITE CHANUTE, KANSAS

JAN 2 7 1998

Prepared for:

BUREAU ONTAL ENVIRONMENTAL ENEMEDIATION

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1.0 INTRODUCTION

This report describes Phase I of a Comprehensive Investigation (CI) of off-site soil and groundwater contamination near the Mid America Refining Company (MARCO) site in Chanute, Kansas. The MARCO site is a former petroleum refinery with suspected off-site migration of contaminants consisting primarily of BTEX (benzene, toluene, ethylbenzene, and xylene) and related petroleum compounds.

The CI is being performed by Golder Associates Inc. (Golder) on behalf of the Kansas Department of Health (KDHE) under the State Water Plan and Contract No. 31060. Phase I activities were conducted based on the December 4, 1997 Work Plan for Comprehensive Investigation Off-Site of the MARCO Site, Chanute, Kansas (Golder 1997).

1.1 Project Objectives

Scoping documentation provided by KDHE indicates that the U.S. EPA is responsible for investigation of contamination within the boundaries of the MARCO property. Since the purpose of Golder's study is to investigate contamination that migrated off-site from the MARCO facility, the CI is to focus on the following objectives.

- ► Investigate the nature and fully delineate the extent of soil and groundwater contamination off-site of the MARCO property.
- ▶ Identify any human and/or environmental targets in the area and identify all domestic water well users located in the impacted area. A water sample is to be collected from all water wells within the impacted area and analyzed for VOCs (volatile organic compounds). Golder is to furnish KDHE with the names and mailing addresses of the well owners, the use of the well, and a copy of the analytical results as they are received by Golder. KDHE will notify the well owners of the analytical results.
- Establish the groundwater flow direction in the study area.

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1.2 Investigative Scope

The standard KDHE Scope of Work (SOW) for a CI was received as an attachment to the October 3, 1997 CI request received from KDHE. As a result of discussions with KDHE, standard SOW components 1 and 5 were to be excluded from the MARCO investigation; component 1 (Historical Evaluation and Site Description) was completed previously, and component 5 (Risk Assessment) is not necessary at this time. Based on the SOW issued by KDHE and subsequent discussions with KDHE, Golder was to focus on investigative components 2, 3, 4, and 6, as summarized below.

- 2. Study Area Investigation A description of the physical characteristics of the study area, including but not limited to geology, soils, hydrogeology, surface water hydrology, land use, and meteorology. In accordance with the objectives described in Section 1.1, hydrogeologic characteristics were emphasized.
- 3. Source Characterization A description of the field activities used to determine and describe the source(s) and release characteristics. Since the U.S. EPA is the lead agency in investigating the MARCO property, Golder's source characterization activities at the MARCO site were limited to sampling of KDHE monitoring wells that were installed at the site in 1986.
- 4. Nature and Extent Characterization A study to determine the horizontal and vertical extent of contamination in soil, groundwater, and surface water, and evaluation of transport pathways.
- 6. Identification of Corrective Action Alternatives Based on data from the CI, develop an initial list of corrective action alternatives that will be evaluated during the Corrective Action Study (CAS).

1.3 Document Organization

This report presents the results of Phase I of the MARCO CI. Background information pertinent to the CI is presented in Section 2, Phase I investigative activities are described in

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Section 3, and regional and site-vicinity conditions are described in Sections 4 and 5, respectively. Conclusions regarding the hydrogeologic/hydrochemical model for the site-vicinity, the extent of contamination, and contaminant transport pathways are presented in Section 6, and an initial list of corrective action alternatives is provided in Section 7. Recommendations for Phase II investigative activities are described in Section 8; the recommended Phase II activities are intended to address data gaps that should be filled in support of the Corrective Action Study. References cited in this report are listed in Section 9. Finally, Phase I field reports, representative Phase I photographs, Phase I data, and other supporting information are presented in Appendices A through I.

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2.0 BACKGROUND INFORMATION

2.1 General Site Description

As shown on Figure 1, the MARCO site is located in northwest Neosho County immediately north of the city limits of Chanute, Kansas. The site is bounded: to the east by U.S. Highway 169 (Santa Fe Avenue) and several businesses; to the north by Ash Grove Road and Ash Grove Cement Company; to the west by EOTT Energy Corp.; and to the south by Hickory Street and several businesses and residences (Figure 2). The current 24.4 acre MARCO site comprises a portion of the southeast quarter of Section 17, Township 27 North, Range 18 East.

The site is situated approximately 1/2 mile south of Village Creek, an eastward flowing tributary to the Neosho River. The Neosho River is located approximately 2 miles east of the site, flows to the south in the site vicinity, and is the primary source of drinking water for the City of Chanute. The intake for the public water supply is located along the western edge of the Neosho River approximately 2 miles southeast of the site (Figure 1).

Topography in the site vicinity is characterized by moderate to gentle relief at the MARCO site and gently sloping to relatively flat areas north and east of the site. The ground surface generally slopes northeastward toward Village Creek and eastward toward the Neosho River. Surface elevations at the MARCO site range from approximately 970 feet near the southwest corner of the property to 915 feet near the northeast corner of the property, while surface elevations east of the site typically range from 915 to 905 feet. Elevations reported herein are based on the National Geodetic Vertical Datum (NGVD) of 1929.

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2.2 MARCO Site History

Processing of crude oil was performed at the MARCO site from 1934 until the facility was shut down in February of 1981. During the period of peak production, the facility processed crude stock at a rate of approximately 2,800 barrels per day (bbl/day), resulting in 350 bbl/day of diesel fuel, 550 bbl/day of jet fuel, and 700 bbl/day of gasoline, oil, and kerosene (KDHE 1987). Asphalt was produced from the remaining crude bottom products.

Owners/operators of the site are summarized below.

1934 to 1943 Petroleum Products Company, Inc.

1943 to ~1956 Missouri Farmers Association Refining Company

~1956 to 1973 Mid America Refining Company

1973 to 1980 Kemco Petroleum Company

Since shut down of the facility in 1981, the site has been owned by Producer Group, Inc. and Chanute Engineering and Refinery Company. On July 1, 1985, 4.6 acres in the northwestern portion of the original site was sold to Fairway Crude, Inc., a crude oil purchasing company. The remaining approximate 25-acre parcel was leased to Rose Chemical Company on February 1, 1986. Although Rose Chemical planned to reactivate the old refinery and develop a PCB destruction plant at the site, these plans were stymied by public opposition. Ownership of the 24.4-acre parcel is currently in the name of the Robert Cooley Trust of Lawton, Oklahoma.

As part of a cooperative agreement with the U.S. EPA, KDHE conducted a Pre-NPL Preliminary Assessment and Site Investigation at the MARCO site in 1986. KDHE investigations at the site included monitoring well installation and sampling of groundwater, surface water, solids, and air; monitor wells installed as part of the 1986

field program are shown on Figure 2. These investigations culminated in KDHE submittal of a comprehensive report (KDHE 1987) that described what was known about the site. Much of the historical information included in this Golder report were obtained from the 1987 KDHE report and associated planning documents (KDHE 1985a, 1985b, 1986a, and 1986b). Pertinent excerpts from the 1987 KDHE report are included in Appendix A.

Prior to initiation of KDHE field investigations at the site in 1986, potential contaminant source areas were determined. It was noted that areas of alleged contamination totaled approximately 3 to 8 acres (KDHE 1986b). Portions of the site that were at least initially excluded from KDHE investigations due to suspected contamination included several waste disposal areas, as shown on Figure 2. MARCO waste products and site disposal locations are summarized below (KDHE 1986b).

- ► API Separator Sludge Bottom sediments that accumulated at the API separator and waste collection facilities were placed in the BS Pit, located near the northwest corner of the site.
- ► Leaded Tank Bottoms Leaded tank bottoms were placed in the south-central portion of the site approximately 5 feet west of Tank No. 17. These waste products were covered with approximately 6 to 18 inches of soil.
- ► Jet Fuel Filter Clay Spent filtrol clay was mixed with fly ash and placed in the northeast portion of the site.
- ► *Drum Pile* Unidentified drums and other containers were present in the west-central portion of the site.

Little has been done at the MARCO site since 1987. In 1993, in response to KDHE notification of a potentially hazardous condition, the U.S. EPA removed mercury from the former site laboratory. Recent activities at the site have included: 1) salvaging of selected storage tanks and pipes; and 2) U.S. EPA securing of the site by installation of fencing where adequate fencing is not currently in place. Salvaging operations at the site have

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resulted in surficial releases of crude oil in portions of the site, as confirmed during an October 17, 1997 site visit by KDHE and Golder.

2.3 Landowner Interviews

Interviews with site-vicinity landowners and others with historical information about site-vicinity operations were helpful in compiling information that is pertinent to investigation of off-site contamination from the MARCO site, as described below.

Bill Gericke, Owner of Gericke Iron & Metal (1212 North Santa Fe Avenue)

The Gericke scrap metal operation is located adjacent to the site immediately east of Santa Fe Avenue. Mr. Gericke reported that several excavations near his property resulted in observation of contaminated groundwater within approximately 6 feet of the ground surface, including: 1) tank excavation north of the Gericke shop area; 2) excavation at the east end of the truck scales located south of the shop area; and 3) utility trenching near the eastern edge of Santa Fe Avenue during the summer of 1997. Mr. Gericke believes that the source of the contaminated groundwater is the MARCO site.

Mr. Gericke also noted other historical operations pertinent to the current CI. He reported that a service station was located in the southern portion of what is now his property; the service station was originally owned by Ketchum Oil Company, then was purchased by Gardner Oil Company. It is also noteworthy that the area east of Santa Fe Avenue near the Gericke property was historically a swamp, but was filled to achieve the current grade. Mr. Gericke reported that prior to his purchasing the property, the previously topographically low area near his property was filled with miscellaneous debris, such as brick and household refuse.

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Corky Tasche, Owner of Corky's Used Cars (1318 North Santa Fe Avenue)

A used car dealership, upholstery shop, and automobile body shop owned by Mr. Tasche is located near the northeast corner of the MARCO site and immediately north of the Gericke operation. Mr. Tasche confirmed that an unknown thickness of fill materials was placed in the previously swampy area east of Santa Fe Avenue. He also reported that a smelter was once located on what is now his property. Based on discussions with Mr. Tasche, a former MARCO employee, the MARCO facility produced JP-4 jet fuel and both heavy and light grades of diesel.

Leroy Chard, Operator of Total Service Station (1125 North Santa Fe Avenue)

A Total Service Station is located near the southeast corner of the MARCO site on the west side of Santa Fe Avenue. This service station, which was previously owned by Fina Oil and Chemical Company (Fina), has been the subject of two environmental investigations, as summarized below.

- In May of 1990, Fina removed one 7,000-gallon and two 6,000-gallon underground storage tanks (USTs) used for virgin gasoline and diesel fuel storage, and one 300-gallon waste oil UST (GTI 1990). Soils present near the gasoline/diesel UST basin were impacted by gasoline, and soils near the waste oil basin were impacted by petroleum hydrocarbons. Due to excavation constraints, not all soil impacted by petroleum hydrocarbons was removed from the excavation areas.
- A site assessment was performed at the former Fina Service Station in 1995, as reported by Geraghty & Miller in 1996. This investigation included installation of eight groundwater monitoring wells, soil sampling, and groundwater monitoring. High concentrations of BTEX were detected in groundwater samples collected from northern monitoring wells, located closest to the MARCO site. The site assessment concluded that the MARCO site was the source of the most significant groundwater contamination detected in the Fina wells (Geraghty & Miller 1996).

Groundwater monitoring wells at this service station are being sampled on an ongoing basis. Based on the most recently reported groundwater monitoring event (September 9, 1997), the groundwater flow direction is generally to the east, although northeast and southeast flow components were also indicated (Terracon 1997b, excerpts of which are provided in Appendix B-1). Consistent with the results of the 1995 investigation, BTEX concentrations were highest in monitoring wells located immediately south and southeast from the MARCO site.

Mr. Chard, the longtime operator of this service station, provided additional information on historical operations in the site vicinity. He reported that the Gardner Oil Company Service Station, which was located in the southern portion of property currently owned by Bill Gericke, was closed in approximately 1958. Two of the monitoring wells installed by Fina in 1995 are located on the east side of Santa Fe Avenue, near the former Gardner Service Station. Mr. Chard also reported that a Derby Service Station was located immediately south of the current Total Service Station; Mr. Chard noted that gasoline releases were documented at the Derby Service Station, which was closed in approximately 1989.

EOTT Energy Corp.

The EOTT Energy Corp. (EOTT) property is located immediately west of the Marco site. In approximately 1988, EOTT purchased Fairway Crude, Inc. (FCI), the crude oil purchasing company that acquired 4.6 acres of the northwest portion of the original MARCO site in 1985. Jim Fredrick of EOTT reported that in 1985, FCI installed a monitoring well adjacent to a salt water storage tank located west of the MARCO site. This well was sampled as part of the MARCO site investigation performed by KDHE in 1986. Mr. Fredrick reported that this monitoring well was decommissioned in 1987 when the storage tank was removed.

While looking for the FCI monitoring well on October 17, 1997, KDHE and Golder noted a cased borehole near the eastern edge of EOTT property. This borehole contained steel casing and was open at the ground surface. Mr. Fredrick reported that the cased borehole noted on October 17 was likely a natural gas exploration borehole that was approximately 200 feet deep when drilled; therefore, this potential monitoring location is much deeper than the uppermost aquifer zone targeted by the current investigation, and would likely not yield pertinent water quality data.

Jim Shea, Plant Manager for Ash Grove Cement Company

As part of the 1986 investigation of the MARCO site, KDHE sampled a water well located north of the site on Ash Grove Cement Company property. Based on discussions with Jim Shea of the Ash Grove Cement Company, this well is no longer operational. KDHE records indicate that this well was plugged.

City of Chanute Public Works Department

Trenches for underground utilities could potentially function as preferential pathways for migration of contaminants from the MARCO site. Information on site vicinity utilities was obtained from Jim James, Larry Shepard, and Carl Ware of the Chanute Public Works Department. A CAD file showing current utility lines near the MARCO site was obtained from Carl Ware, the location of abandoned water and sewer lines was obtained from Larry Shepard, and Jim James confirmed that there are no abandoned gas lines near the site. The location of current and abandoned utility lines are shown on Figure 3.

Utility trenches near the site have been excavated to various depths. Based on information provided by Larry Shepard, approximate cover depths for Chanute utility lines are as

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follows: water lines covered by 3 to 3.5 feet; sewer lines covered by 8 feet; and gas lines covered by 2 feet.

Historical filling of the area near the Gericke and Tasche properties was also discussed with City of Chanute personnel. According to Larry Shepard, construction debris was primarily used to fill this area, although some household refuse could have been included.

William Thornton, KDHE District Geologist

William Thornton provided information on a December 14, 1989 hazardous chemical spill that is potentially pertinent to contaminant investigations east of the MARCO site. The spill occurred near downtown Chanute when an Atchison, Topeka and Santa Fe Railway Company tank car was ruptured, releasing 19,000 gallons of Chem-Fuel K Blend, a waste solvent mixture. The Material Safety Data Sheet indicates that the two primary hazardous ingredients in Chem-Fuel K Blend are xylene (up to 60 percent) and toluene (up to 50 percent). According to laboratory analyses provided by Cadence Chemical Resources, Inc., the waste solvent mixture transported in the ruptured tank car included 17.8 percent toluene, 11.2 percent xylene, and 15.9 percent unknown solvents.

Shortly after the tank car was ruptured, it was transported about 1 mile north to a topographically low area (commonly referred to as the northern site) located approximately 600 feet east of the MARCO facility, as shown on Figure 2. Cleanup crews estimated that "perhaps 60 percent of the spillage had occurred at the north site" (KDHE 1990); this suggests that approximately 11,000 to 12,000 gallons of Chem-Fuel K Blend was released in an area inferred to be hydraulically downgradient from the MARCO site.

Cleanup of the northern spill area was initiated on December 20, 1989. The northern spill site "was located within a demolition dump area of kiln dust, lumber, rock debris, and

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soil," resulting in visible contamination extending to a depth of 1.5 feet (KDHE 1990). Excavation at the northern site typically extended to depths ranging from 2 to 3 feet, resulting in approximately 900 tons of soil being removed. KDHE directed that site cleanup criteria be consistent with Toxicity Characteristic Leaching Procedure (TCLP, 40 CFR Ch. 1, Appendix 1) contaminant concentrations. Materials excavated from the northern spill area were transported for off-site disposal.

Surface water samples were collected from the northern spill area in January 1990 and June 1990. Laboratory analyses for the January 1990 sampling event indicated toluene at 3.49 parts per million (ppm), while the June 1990 sampling event indicated toluene at 0.213 ppm. Based on the composition of Chem-Fuel K Blend and the results of surface water sampling performed during the site cleanup, potential releases to the groundwater from the MARCO site could be difficult to distinguish from potential releases attributable to the waste solvent spill area located east of the MARCO site, particularly considering the presence of organic constituents such as toluene.

2.4 Surface Conditions

2.4.1 Surficial Soils

The primary surficial soil types in the site vicinity are the Osage silty clay and the Bates loam (USDA 1982). The Osage silty clay, which is a flood plain deposit, is present in the eastern portion of the study area (Figure 4). Permeability values for the Osage silty clay are generally less than 4 x 10⁻⁵ centimeters per second (cm/sec). The Bates loam, which is present in the topographically higher areas located west of the flood plain, is better drained than the Osage silty clay, and is generally comprised of 15 percent clay. The Bates loam is characterized by permeability values ranging from 10⁻² to 10⁻⁴ cm/sec.

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2.4.2 Surface Water

Surface water at the MARCO site flows eastward toward Santa Fe Avenue, where it discharges into an ephemeral drainage located north of the site. This ephemeral drainage discharges into Village Creek, a tributary to the Neosho River (Figure 1). MARCO operational plans called for site runoff to be collected at an oil/water separator and pumping facility located in the eastern portion of the site. However, while the site was operating, the capacity of the separator/pump facility was exceeded during periods of high rainfall, resulting in off-site discharge of potentially contaminated surface water. KDHE file review indicated that historical contamination of Village Creek was attributed to contaminated runoff from the MARCO site (KDHE 1987); this contamination was documented as early as 1940.

In the site vicinity, surface water flow is to the east (Neosho River) and north (Village Creek). Surface water drainage is poor in the vicinity of the railroad tracks located east of the site. This swampy area was the location of a waste solvent spill in 1989, as described in Section 2.3.

As part of the 1986 KDHE investigation, three surface water samples were collected from areas suspected of receiving contaminated discharges from the MARCO site, as shown on Figure 2. Results of this sampling program, which are included in Appendix A, are summarized below.

- ► MASW1 was collected near the northern site boundary. Although hydrocarbon staining was noted near the sampling site, VOCs were not detected.
- ► MASW2 was collected from an on-site pond coated with tarry hydrocarbons; VOCs were not detected.

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► MASW3 was collected near the eastern site boundary. Although hydrocarbon staining was observed, VOCs were not detected.

Therefore, although surface water sampling near the MARCO site indicated the presence of hydrocarbons, priority pollutants were not detected. Based on the results of the 1986 surface water sampling program and the groundwater emphasis for the MARCO CI, additional surface water quality sampling was not performed in connection with the Phase I investigative activities.

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3.0 PHASE I INVESTIGATION

Phase I investigative activities at the MARCO site were performed by Golder and its subcontractor, Hydro-LOGIC, Inc. (HLI) of Eudora, Kansas, a State of Kansas licensed water well contractor (license #602). Investigative field activities conformed to the Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP) presented in the MARCO CI Work Plan (Golder 1997).

The Phase I investigation was performed during the week of December 8, 1997. Daily field reports summarizing the Phase I activities are presented in Appendix C, and photographs of the significant Phase I investigation components are included in Appendix D.

3.1 Preliminary Operations

Prior to the initiation of Phase I drilling activities, Golder contacted pertinent utility and City of Chanute personnel to arrange the necessary utility clearances. Golder personnel arrived on site to flag drilling locations and then observed and documented the subsequent site utility clearance. A KDHE Utility Clearance Checklist was submitted to KDHE prior to the initiation of drilling activities on December 9, 1997.

Concurrent with the site-wide utility clearance, Golder personnel contacted landowners who had previously agreed to allow property access during investigative activities. Golder viewed the proposed drilling locations with the landowners and addressed questions or concerns pertaining to drilling activities.

Additionally, water levels in the three KDHE wells that are located within the MARCO property boundary were measured. Calculated water level elevations for wells M1, M3,

and M4 confirmed that the overall direction of groundwater flow was to the east in the site vicinity. The confirmation of the site flow direction helped to validate the appropriateness of the proposed probe hole locations.

3.2 Field Operations

3.2.1 **Drilling Program**

HLI performed drilling operations using a truck mounted, SIMCO Earthprobe 200TM "direct push" sampling unit. During the field investigation 20 probe locations near the MARCO facility were advanced to bedrock refusal. Probe locations are shown on Figure 5. Of these 20 sample locations, 11 are located around the site perimeter (P-1 to P-11), and nine additional sampling locations (P-12 to P-20) are located downgradient of the site, within approximately 900 feet from the facility boundary. Probe hole locations P-7, P-8, and P-9 are located hydraulically upgradient from the MARCO facility.

Soil Coring

The HLI "direct push" unit was used to obtain core samples for stratigraphic determination at all 20 probe hole locations. Contaminant screening samples were collected at all probe hole locations with the exception of probe hole P-1.

Continuous core soil samples were collected using a 48-inch long, 1.75-inch ID (inside diameter) open barrel sampler fitted with disposable, acetate liners. The core barrel was driven by 2-inch OD (outside diameter), flush-threaded hollow probe rods (HPRs). During drilling the core barrel was retrieved after every 4 feet of advancement and the full sleeve was replaced with a new liner. This methodology was utilized until drilling refusal was observed, typically at the bedrock contact. Solid stem augers of 3-inch diameter were used

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provided as Photo D-1A of Appendix D.

to drill through cemented zones. A representative photograph of the "direct push" rig is

Soil core material was extruded from the acetate liner and placed on clean plastic for inspection, field screening, and logging. A representative photograph of the extruded soil core is provided as Photo D-1B of Appendix D. Geologic samples were logged by Golder personnel according to Golder Technical Procedure (TP) 1.2-5 (Drilling, Sampling, and Logging of Soils), TP 1.2-6 (Field Identification of Soil), and the Unified Soil Classification System (USCS, as described on Figure E-1 of Appendix E. Soil borehole logs for probe holes P-1 through P-20 are provided in Appendix E.

Soil Screening

Soil screening samples were collected at all probe hole locations except P-1. Following core extrusion, a soil sample was collected from immediately above the water table, placed in a sample bottle and promptly cooled to 4° Celsius. The sample was then screened by HLI using the trailer-mounted, self-contained mobile analytical laboratory. Soil screening samples are discussed in Section 3.3.2.

Contaminant screening of the recovered soil core was accomplished using a Photovac Microtip MP-1000 Photoionization Detector (PID). Prior to it's use the PID was calibrated according to manufacturer specifications, using 100 ppm isobutlyene calibration gas. At 2-foot intervals, sections of core were isolated in plastic bags and PID readings were taken directly from the bag. This method was used to minimize the influence of contaminants not associated with the soil sample. Intervals where core PID readings exceeded background levels were recorded in the remarks column on the soil borehole log (Appendix E).

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Probe holes not converted to mini-wells were plugged per State requirements. EnviroplugTM medium grit, high solids sodium bentonite was used to seal borings to just below ground surface. Then native surface materials were used to restore the surface to it's original condition. All soil core material was containerized at the drill site and then placed within a concrete-lined truck scale vault at the MARCO property site. Waste water generated during decontamination of drilling equipment was containerized in DOT approved 55-gallon drums. A screening sample was then taken from the drum and sent to the mobile laboratory for analysis. The contents of the drums were disposed of on the ground following confirmation that contaminants were not detected in the waste water.

Prior to and following drilling activities all drilling equipment and materials were thoroughly decontaminated. Decontamination procedures involved thorough scrubbing with a potable water and non-phosphorus soap (LiquinoxTM) solution, followed by a triple rinse of potable water. Additionally, drilling personnel used new disposable latex gloves at each drilling location. These sanitary practices were used to limit the possibility of cross-contamination between probe hole locations during field activities.

Groundwater Screening

The HLI "direct push" unit was used to obtain groundwater samples for contaminant screening. At probe locations where a mini-well was not installed, the groundwater screening probe was driven to the bedrock contact following soil coring activities. The well point sampling tool used is 1-inch OD x 0.76-inch ID x 24 inches long and has 15 mill-cut slots, each 2 inches long and 0.020-inch wide. The sample tool was advanced down-hole using 1-inch OD x 0.76-inch x 24-inch flush threaded HPRs.

After the mill-slotted sampler was advanced into position, polyethylene tubing was lowered into the sampler. A groundwater sample was collected using the hydroprobe vacuum

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system to draw the sample to the surface. A minimum of three tubing volumes was purged prior to collecting the groundwater sample. Groundwater screening samples are further discussed in Section 3.3.3.

3.2.2 Mini-Wells

Well Installation

To supplement existing monitor well data near the MARCO site, 11 of the Phase I probe holes were converted to mini-wells (Table 1 and Figure 5). Of the six mini-wells installed around the site perimeter, two wells (P-7 and P-9) were installed upgradient, one well (P-6 was installed immediately south, one well (P-10) was installed immediately north, and two wells (P-2 and P-4) were installed immediately downgradient. Four mini-wells were installed at locations further downgradient from the MARCO site. These wells were placed to monitor historically problematic areas including: downgradient from KDHE monitor well M1 (P-14 and P-19); the existing and former service station locations near the southeast corner of the MARCO site (P-16), and; the 1989 railroad tank car solvent spill site (P-18). Additionally, P-12 was installed to allow evaluation of whether a groundwater flow component trends to the northeast towards Village Creek.

In accordance with State requirements, groundwater mini-well locations were drilled to a minimum of 10 feet bgs using 2.25-inch ID by 6-inch OD hollow stem augers. The augers were left in place during subsequent coring, sampling, and mini-well installation to ensure that the boring would not collapse as a result of probing vibrations.

Following the completion of coring activities, 2-inch OD HPRs with a steel anchor drive point were advanced through the center of the augers to the desired well completion depth. The HPRs were then pulled up approximately 3 inches and nominal 1-inch diameter,

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schedule 40 PVC well screen and riser pipe were lowered through the HPRs to the bottom of the boring (see Photo D-2A of Appendix D). The well string was then attached to the anchored drive point by male-female threading. Ten feet of 0.010-inch mill-slotted well screen was used in each well, with the exception of locations P-7 and P-9, where 5-foot screens were required because of the shallow depth to bedrock. The wells were sand packed with 12-40 grit sand that was gravity fed and typically, extended 2 to 3 feet above the top of the well screen. After the well was set the HPRs were withdrawn, and high solids sodium bentonite chips (medium size Enviroplug bentonite) were gravity fed through the augers as they were removed from the ground. The use of hollow stem augers helped to ensure a complete seal from at or below the water table to near ground surface. In addition to the monitor well construction logs provided in Appendix F, mini-well construction details are summarized in Table 1. KDHE Water Well Record forms were submitted by HLI for each of the Phase I mini-wells.

Surface completion's were above-grade and flush-mount, depending on the proximity of the well to trafficked areas. Above-grade surface completions include probe hole locations P-7, P-9, P-18, and P-19. Above-ground completions were protected by 4-inch x 4-inch square steel casing with lockable lids. Additionally, 4-inch diameter bumper posts, approximately 3 feet high, were placed on either side of the protective casing to help prevent accidental damage. A typical above-grade completion is shown in Photo D-3A of Appendix D. The remaining mini-well locations were flush-mount completions; Mr. Don Taylor of the KDHE Bureau of Water, Industrial Program Section authorized these flush-mount completions in a letter to HLI. Both types of completions include sloping, 2-foot square by 6-inch thick concrete pads and lockable caps. A schematic view of a flush-mount completion is provided as Figure 6. A typical flush-mount completion is presented as Photo D-3B of Appendix D.

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Probe hole and mini-well locations were surveyed by Cornerstone Surveying of Cherryvale, Kansas. Elevations are based upon U.S.C. & G.S. Benchmark "X 245 1934" and adjusted to the National Geodetic Vertical Datum (NGVD) of 1929. Probe hole survey locations, ground surface, and top of casing (TOC) elevations for the Phase I mini-wells are summarized in Table 1.

Well Development/Sampling

The mini-wells were developed using the Hydroprobe vacuum system (see Photo D-2B of Appendix D). Static water levels were measured prior to development and casing volumes were calculated. A minimum of five well casing volumes were removed during purge activities and field parameters of pH, temperature, and conductivity were recorded approximately every casing volume. Stabilization of these parameters, combined with visual observation that purge water was clearing of sediment, generally indicates that development is complete and formational water is being removed. Parameter stabilization was defined as less than a ±10 percent change during three consecutive readings. Following parameter stabilization, groundwater screening samples were collected as discussed in Section 3.3.3. Mini-well development and parameter information is summarized on Golder's well development data sheets provided in Appendix G.

Waste water generated during development, sampling, and decontamination activities was containerized in DOT approved 55-gallon drums. A screening sample was taken from the drum and sent to the mobile laboratory for analysis. The drums contents were disposed of on the ground following confirmation that contaminants were not detected in the waste water. Waste water from sample locations that were apparently contaminated were combined into a single drum. This DOT approved 55-gallon drum was sealed, labeled, and secured within the MARCO property boundary.

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Prior to and following development activities all sample equipment and materials were thoroughly decontaminated. Polyethylene tubing was not re-used and was disposed of properly. Decontamination procedures involved thorough scrubbing with a potable water and non-phosphorus soap (LiquinoxTM) solution, followed by a triple rinse of potable water. Additionally, drilling personnel used new disposable latex gloves at each well location. These sanitary practices were used to limit the possibility of cross-contamination between probe hole locations during field activities.

3.3 Sample Collection

3.3.1 QA/QC Sample Types

In addition to the groundwater and soil screening samples collected at each sample location described herein, QA/QC samples were collected as appropriate to monitor laboratory and field procedures. HLI collected internal QA/QC samples to monitor mobile laboratory performance. Concurrent with sampling activities, Golder collected QA/QC samples to be analyzed by an independent laboratory. Off-site analytical laboratory testing was performed by Pace Analytical Services, Inc. (Pace) of Lenexa, Kansas. Analytical testing was performed in accordance with U.S. EPA SW-846 and the methods and QA/QC protocol described in the Pace Assurance Plan previously submitted to KDHE. The following paragraphs describe the Phase I QA/QC sampling protocol.

Trip Blank

A trip blank is a laboratory-prepared volatile organic compound (VOC) sample bottle containing clean water that accompanies the sample cooler from the laboratory, to the job site, and then back to the laboratory. Typically, one set of trip blanks per sample cooler are analyzed for the contaminants of concern upon return to the laboratory. The intention

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of a trip blank is to verify that primary sample bottles have not been contaminated during the time away from the laboratory. Pace provided one set of trip blanks for the Phase I investigation. Analytical results for this sample are provided in Appendix I.

Duplicates

Duplicate samples were collected by sampling personnel in a manner identical to the primary sample. The duplicate sample is intended to verify that the results from the primary sample are accurate and reproducible. Four internal duplicate samples (3 soil and 1 groundwater) were collected by HLI during field activities. Analytical results for duplicate samples P5-S-1, P6-S-1, P15-S-1, and P18-W-1 are provided in Appendix H. Ten duplicate samples (3 soil and 7 groundwater) were collected by Golder concurrent with field screening sample collection. Duplicate samples P2-W-1D, P3-W-1D, P7-W-1D, P7-S-1D, P14-W-1D, P14-S-1D, P15-W-1D, P18-W-1D, P18-S-1D, and P20-W-1D were sent to Pace laboratories for independent analysis. Analytical results for these duplicate samples are provided in Appendix I.

3.3.2 Soil Screening Samples

Using the methodology discussed in Section 3.2.1, soil screening samples were collected from all probe hole locations, with the exception of location P-1. Soil samples were collected from immediately above the water table, placed in a labeled 100 ml glass containers, and immediately cooled to 4° Celsius.

Soil screening samples were delivered to the HLI on-site mobile analytical laboratory. This laboratory is equipped with an SRI 8610 (FID/PID) gas chromatograph with a U.S. EPA purge and trap, dry electrolytic conductivity detector (DELCD) and a 10-port autosampler. Soil samples were analyzed by HLI for the parameters shown in Table 2 using

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Method 8021. Detection limits for soil sample field screening analyses were 10 ppb for purgeable aromatics and 5 ppb for purgeable halocarbons. In addition, to allow evaluation of possible jet fuel contamination, soil samples were field screened for total petroleum hydrocarbons (TPH) using Method OA-2 with a detection limit of 1 ppm.

Duplicate soil samples collected for off-site analysis were sent to the Pace laboratory and were subject to the methodologies stated above. Throughout duplicate sample collection and shipment strict chain-of-custody (COC) procedures were followed. Soil sample results and COC forms for on-site and off-site analysis are provided in Appendix H and Appendix I, respectively. A summary of contaminants detected in wells sampled by Golder and HLI during the Phase I investigation is provided in Table 3.

3.3.3 Groundwater Screening Samples

Groundwater screening samples were collected from open borehole and mini-well locations using the methodologies discussed in Sections 3.2.1 and 3.2.2, respectively. Following proper purge/development protocol, groundwater samples were collected at each probe hole location. For site screening samples, two 40 ml unpreserved VOC bottles were slowly filled, minimizing turbulent flow and the introduction of bubbles. The vials were slightly overfilled, creating a meniscus, and then capped. The bottles were then inspected for the presence of bubbles, labeled, and immediately cooled to 4° Celsius.

Groundwater screening samples were analyzed on site by an HLI portable gas chromatograph. Groundwater samples were analyzed by HLI for the parameters shown in Table 2 using Method 8021. Detection limits for groundwater screening analyses were 2 ppb for purgeable aromatics and 1 ppb for purgeable halocarbons. In addition, to allow evaluation of possible jet fuel contamination, groundwater samples were field screened for TPH using Method OA-2 and a detection limit of 0.5 ppm. Groundwater sample results

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for on-site analyses are provided in Appendix H. A summary of contaminants detected in wells sampled by Golder and HLI during the Phase I investigation is provided in Table 3.

For locations where samples for off-site analysis were collected, two 40 ml VOC bottles, preserved with hydrochloric acid (HCl), were filled according to the sampling methodology presented above. Additionally, a one liter (L) amber glass container was filled for OA-2 TPH analysis.

Duplicate groundwater samples collected for off-site analysis were sent to the Pace laboratory and were subject to the methodologies stated above. Throughout duplicate sample collection and shipment strict chain-of-custody (COC) procedures were followed. Groundwater sample results for off-site analyses are provided in Appendix I.

3.3.4 KDHE Monitor Wells

Groundwater screening samples were collected from KDHE monitor wells M1, M3, and M4 during the December 1997 Phase I investigation. The monitor wells are located within the MARCO property boundary (Figure 5). The wells were purged and sampled by Golder and HLI personnel. Purge and sample activities were accomplished using a WhaleTM submersible 12 volt pump.

Static water levels were measured prior to sampling and casing volumes were calculated. A minimum of three casing volumes were removed during purge activities and field parameters of pH, temperature, and conductivity were recorded approximately every 1/2 casing volume. Stabilization of these parameters generally indicates that purging is complete and formational water is being removed. Parameter stabilization was defined as less than a ± 10 percent change during three consecutive readings.

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The KDHE monitor well samples were collected and analyzed according to the protocol discussed previously. Monitor well purge and parameter information is summarized on Golder's well development data sheets provided in Appendix G. Groundwater sample results for on-site analyses are provided in Appendix H. A summary of contaminants detected in wells sampled by Golder and HLI during the Phase I investigation is provided in Table 3.

The submersible pump and sampling equipment was thoroughly decontaminated between sample points using previously discussed methods. New latex gloves were worn by personnel throughout sampling activities.

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4.0 REGIONAL CONDITIONS

Subsurface conditions in Neosho County have been described by the Kansas Geological Survey (Jungmann 1966). Except as otherwise noted, the following regional subsurface descriptions are attributed to this Kansas Geological Survey publication.

4.1 Geology

4.1.1 Bedrock Units

The Chanute area is underlain by bedrock units of the Pennsylvanian System, Missourian Stage, Kansas City Group. In order of increasing depth, these bedrock units include the Chanute Shale, Drum Limestone, and Bonner Springs Shale. These strata regionally dip to the northwest at approximately 20 feet per mile, although bedrock dips locally range from zero to 40 feet per mile.

In Neosho County, the Chanute Shale is comprised of two sandstone members and an intervening shale member. Drill holes located west and southwest of the City of Chanute indicate that the entire Chanute bedrock unit ranges in thickness from 30 to 110 feet. Individual members of the Chanute bedrock unit are characterized in ascending order as follows.

Noxie Sandstone Member - This unit is described as fine to very fine-grained quartzose sandstone that is thin-bedded to medium-bedded, ranges in thickness from 1 to 30 feet, and is most commonly cemented with silt, silica, and iron oxide. Near Chanute, the Noxie Sandstone was apparently deposited in an approximate 4-mile wide channel that is oriented northeast-southwest.

Unnamed Shale Member - The upper portion of the Noxie Sandstone grades into an unnamed shale unit that is as much as 7 feet thick southwest of the City of Chanute, although this shale unit is not continuous in western

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Neosho County. This shale unit is characterized as light grayish-green clay shale that is slightly silty in the upper 2 feet. The Thayer Coal, which is typically 0.4 to 2 feet thick, is often present at the top of the unnamed shale unit.

Cottage Grove Sandstone Member - Except for the Cottage Grove Sandstone being thicker-bedded than the Noxie Sandstone, these units are nearly indistinguishable. Where weathered, these sandstone strata are yellowish-orange to deep brownish-red, and are very light gray where unweathered.

4.1.2 Alluvium

The Neosho River Valley is characterized by alluvial deposits of Pleistocene and Recent ages, although the Recent alluvium is typically confined to the active stream channel. Geologic mapping performed by the Kansas Geological Survey indicates that the Pleistocene alluvial unit ranges in thickness from 18 to 40 feet, and averages approximately 25 feet in Neosho County. Pleistocene alluvium is characterized as silt and fine to coarse sand. Coarse chert pebbles are commonly present in an approximate 3-foot thick zone at the base of the alluvial deposits (Jungmann 1966).

4.2 Hydrogeology

Groundwater in Neosho county is present under both confined and unconfined conditions. Alluvium and weathered bedrock in the Chanute area are generally characterized by unconfined groundwater conditions, while wells constructed in the unweathered bedrock of Neosho County typically encounter confined groundwater conditions (Jungmann 1966).

The major source of groundwater recharge to weathered bedrock aquifers located in the upland areas of Neosho County is local precipitation, particularly during the spring months. Recharge and discharge relationships of the Neosho River, adjacent unconsolidated units, and underlying bedrock units are not well defined in Neosho County.

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The most productive bedrock aquifers in Neosho County are the sandstone members of the Chanute Shale. In the western portion of the County, wells completed in the Noxie and Cottage Grove sandstone members yield 0.5 to 15 gallons per minute (gpm). East of Chanute, these sandstone units reportedly yield up to 4 gpm. Wells installed in the Pleistocene alluvium in Neosho County yield 3 to 8 gpm (Jungmann 1966).

4.3 Groundwater Quality

Groundwater in Neosho County is commonly highly mineralized, particularly in the limestone and shale aquifers. Groundwater in the sandstone and alluvial aquifers is generally softer and of better quality (Jungmann 1966).

4.4 Nearby Water Wells

The previous MARCO investigation concluded that there were no known domestic wells within 1 mile downgradient from the site (KDHE 1987). Therefore, it was concluded that there was no immediate threat to private drinking water supplies. As previously noted, the City of Chanute's municipal water supply is obtained from the Neosho River.

Review of current KDHE water well records indicates that there are no registered wells in the downgradient area of concern. Based on the current understanding of site vicinity groundwater flow conditions, the downgradient area of concern extends eastward from the MARCO site towards the Neosho River. As shown on Figure 4, registered wells are not present in this downgradient area. Although several wells are located approximately 1 mile south of the site, and a total of two wells are located about 1/2 mile west and northwest of the site, these wells are not situated in potential impact areas. As previously noted, Fairway Crude and Ash Grove Cement wells were located near the MARCO site (Figure 4), but no longer exist. Therefore, currently available data support the previous KDHE

conclusion that the MARCO site does not pose an immediate threat to private drinking water supplies.

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5.0 SITE-VICINITY CONDITIONS

5.1 Geology

Previous Investigative Results

Drilling performed at the site in 1986 by KDHE resulted in four boreholes that fully penetrated the alluvial units, as shown on the borehole logs and geologic cross sections presented in Appendix A. Based on the KDHE borehole logs, unconsolidated units at the MARCO site are characterized in descending order as follows.

- ► 1 to 3 feet of top soil and/or fill
- ▶ 2 to 9 feet of brown to black clay
- ► 5 to 13 feet of brown to black silty, sandy clay to silt
- ► 6 to 8 feet of brown to reddish brown sand to silt
- ▶ 2 feet of coarse sand with chert pebbles

A generalized description of alluvial and uppermost bedrock units at the MARCO site is (in descending order) as follows (adapted from KDHE 1987).

Silty Clay - This unit was 7 feet thick at well M4 and 22 feet thick at well M3, indicating that this unit increases in thickness towards the east. The upper portion of this unit was characterized as moderately low permeability, brown to black clay. The sand, silt, and moisture content of this unit increased with depth.

Sand/Sandstone - A total of 3 to 10 feet of wet sand or sandstone was encountered in the KDHE borings. This relatively high permeability unit was encountered at depths ranging from 9 feet at M4 to 23 feet at M3, and included 1 to 4 feet of sandstone at wells M3 and M4 (apparently the

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Cottage Grove Sandstone Member). In wells M1 through M3, this unit included 2 feet of coarse sand and chert pebbles directly overlying shale.

Shale - The KDHE borings encountered shale at depths ranging from 13 feet at well M4 to 26 feet at well M3. This dark gray to bluish-gray shale unit was described by KDHE as tight and dry, and was noted to be the unnamed member of the Chanute Shale.

Subsurface investigations near the current Total Service Station (Geraghty & Miller 1996), which is located near the southeast corner of the MARCO site, encountered different stratigraphy than that in the KDHE borings. The Geraghty & Miller borings typically encountered 1 to 2 feet of top soil underlain by 3 to 4 feet of sand and approximately 9 feet of silty clay.

The Geraghty & Miller investigation included grain size analyses and falling head permeameter testing of two soil samples from borings at the Total Service Station. The sample with 70 percent fines had a hydraulic conductivity of 8 x 10^{-6} cm/sec, and the sample with 77 percent fines had a hydraulic conductivity of 7 x 10^{-8} cm/sec.

Phase I Investigative Results

Drilling performed during the December 1997 Phase I investigation resulted in 20 boreholes that fully penetrated unconsolidated materials. "Direct push" core methods were utilized and probe holes were advanced to bedrock refusal. Soil borehole logs are presented in Appendix E. Probe hole and geologic cross-section locations are shown on Figure 7. Geologic cross-sections A-A', B-B', C-C', D-D', and E-E' were constructed using Phase I soil borehole logs and KDHE logs from the 1986 investigation. The cross-sections are presented as Figures 8, 9, 10, 11, and, 12, respectively.

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Cross-section A-A' trends southwest/northeast in the upgradient portion of the MARCO site. Unconsolidated material thickness ranges from approximately 2 feet at probe hole P-7, the topographically highest probe location, to over 15 feet at probe hole P-10.

Cross-sections B-B' and C-C' trend southwest/northeast and northwest/southeast, respectively. B-B' and C-C' provide section views of the areas immediately north and south of the MARCO site, as well as the area immediately downgradient of the property, where the cross-sections intersect. Unconsolidated material thicknesses along cross-section B-B' range from approximately 2 feet at probe hole P-6 to 25 feet at P-17. Unconsolidated material thicknesses along C-C' are less variable, ranging from approximately 15 feet at P-10 to about 24 feet at P-14.

Cross-sections D-D' and E-E' trend north to south and are located in the relatively flat area downgradient from the MARCO site. Unconsolidated material thickness is fairly consistent in this area, although an area of soil thinning is suggested near probe holes P-2 and P-20. Phase I stratigraphic data suggest that unconsolidated materials are thinnest in the topographic high areas located west and south of the MARCO site, and increase in thickness to the east toward the Neosho River.

A generalized description of alluvial and the uppermost bedrock units within the investigative area surrounding the MARCO property (in descending order) is as follows.

Topsoil/Fill - Topsoil thicknesses typically ranged from 1 to 3 feet in the vicinity of the site-perimeter probe holes. Topsoil was typically characterized as a yellowish-brown clayey silt with varying amounts of sand and organic material. Probe holes P-12, P-14, P-15, P-16 and P-20 were located in areas of significant historic infilling. Fill depths in these areas ranged from approximately 5 feet at P-15 to greater than 15 feet at P-14. Fill material at P-12 was predominantly kiln dust waste from the Ash Grove Cement Plant. The remaining locations contained varying amounts of fill soil, gravel, organic material and scrap metal.

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Silty Sand/Clayey Sand - Within the investigative area this unit is limited to the area near the southeast corner of the MARCO property boundary. Thicknesses ranged from approximately 3 to 4 feet in wells MW-1 through MW-8, to approximately 1.5 feet at probe hole P-4. This unit was not found at KDHE monitor well M1, nor in probe holes P-3, P-5, P-14, P-15 and P-16. Although this unit is most commonly characterized as a silty sand (SM based on the USCS, as described on Figure E-1 of Appendix E), zones of clayey sand (SC) are locally present.

Silty Clay - This is the predominant unconsolidated unit at the investigative site, although it is not observed at upgradient probe holes P-7, P-8, and P-9. This unit increases in thickness towards the east, with a thickness of approximately 20 feet at P-1 and P-19. The upper portion of the unit is typically black to brown becoming light gray to light brown at depth. The sand and silt content of this unit increased with depth. This unit is characterized as low plasticity clay (CL), although some zones of moderate plasticity clay (CL-CH) are present. Based on qualitative characterization, this unit is characterized by moderate to low permeability.

Sand and Chert Gravel - This sand to sandy gravel unit was encountered in nearly all downgradient probe holes, and ranged in thickness from approximately 0.5 feet to 2 feet. This relatively high permeability sand unit was observed at depths ranging from approximately 2 feet bgs at P-6 to greater than 22 feet bgs at P-14. In probe holes P-1, P-2, P-3, P-4, P-13, P-14, P-15, and P-20 this unit included up to 1 foot of a sandy chert gravel. The upper portion of this granular unit is characterized as a silty sand (SM) or a clayey sand (SC), while the lower portion of this unit is commonly a silty gravel (GM) or a clayey gravel (GC).

Sandstone - Investigative probe holes were typically terminated at refusal within the Cottage Grove Sandstone Member. This relatively high permeability sandstone unit is characterized as a highly weathered, dark yellowish orange, fine to medium grained, very weak sandstone. Depth to the sandstone bedrock contact ranged from 1.5 feet bgs at probe hole P-9 to greater than 24 feet bgs at P-14.

Shale - The shale unit observed in the KDHE 1986 monitor well borings was only encountered at probe hole P-15 during Phase I investigative activities. This unit was characterized as a highly weathered, thinly laminated, medium dark gray, very weak shale. The shale was observed at a depth of 23 feet bgs, just below the sandstone unit. The shale unit is assumed to be the unnamed member of the Chanute Shale.

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A structural contour map of the bedrock surface in the vicinity of the MARCO site is presented as Figure 13. Beneath the MARCO property, the bedrock surface slopes to the northeast at approximately 0.05 feet per foot (ft/ft), while immediately east of the MARCO property, the bedrock surface generally slopes to the east at about 0.01 ft/ft. The Phase I investigations indicate that elevation of the bedrock surface ranges from 954.2 feet (NGVD) at probe hole P-7 to 889.5 feet (NGVD) at P-18. As illustrated by Figure 13, a bedrock high trending roughly northwest/southeast is present in the vicinity of probe holes

5.2 Hydrogeology

P-2, P-20, and P-19.

Previous Investigative Results

Based on previous investigations at the MARCO site (KDHE 1987), groundwater at the site occurs within the silty clay unit and the lower sand/upper sandstone unit described in Section 5.1. Although groundwater was encountered in both of these units, previous data indicate that the sand/sandstone hydrostratigraphic unit is the uppermost aquifer in the site vicinity because of the higher transmissivity of this unit relative to the overlying silty clay unit.

In November 1986 and January 1987, groundwater flow within the uppermost aquifer was to the east-southeast at an average horizontal hydraulic gradient of 0.025 ft/ft. Static water levels in the KDHE wells ranged from approximately 3.5 feet to 5.7 feet below ground surface (bgs) in 1986 and 1987. The shale stratum that was encountered below the alluvium was assumed by KDHE to be a low permeability confining unit.

Water level monitoring near the Total Service Station by Geraghty & Miller (1996) and Terracon (1997a and 1997b) suggests that groundwater flow was in a general easterly

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direction at an average horizontal hydraulic gradient of 0.02 to 0.025 ft/ft, which is consistent with the KDHE data. Static water levels typically ranged from 1.5 to 4 feet bgs.

Slug withdrawal hydraulic conductivity testing was performed in wells MW-1 and MW-2 at the Total Service Station (Geraghty & Miller 1996). The resulting hydraulic conductivity values ranged from approximately 2-3 x 10⁻⁵ cm/sec.

Phase I Investigative Results

Results of the Phase I investigation support the hydrogeologic model previously developed for the site-vicinity (Golder 1997). Investigations performed to date indicate that the site is typically underlain by the following major hydrostratigraphic units: 1) a silty clay unit that tends to function as an aquitard beneath and downgradient from the MARCO property; and 2) underlying the silty clay unit, a relatively high permeability zone that is generally the uppermost aquifer beneath the site. Although the silty clay aquitard is not present upgradient from the MARCO property, it is approximately 20 feet thick in areas east of the site.

The underlying uppermost aquifer is generally comprised of: 1) the sand and gravel unit that directly underlies the silty clay statum; and 2) the upper portion of the Cottage Grove Sandstone, which is highly weathered and apparently permeable. The combined thickness of the units that comprise the uppermost aquifer beneath the site is estimated to range from 2 to 5 feet. Groundwater within the uppermost aquifer is typically present under semi-confined conditions, as indicated by Figures 8 through 12.

Although laterally discontinuous, the shallow sand unit present near the southeast corner of the MARCO property is potentially an important hydrostratigraphic unit. Where present,

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this sand unit typically extends from approximately 1 foot bgs to 4 feet bgs. Based on current data, groundwater within this unit is typically present under unconfined conditions.

Phase I data indicate that groundwater levels in mini-wells constructed near the MARCO facility typically range from near ground surface to about 7.5 feet bgs. On average, the groundwater level is 2 to 3 feet bgs in the vicinity of the Phase I mini-wells. The primary exception is P-18, which is located in the marshy area east of the site. The December 1997 water level measured in P-18 indicated slight artesian conditions. With the exception of P-18, which was considered anomalous, water level data obtained from Phase I investigative mini-wells and previous KDHE monitor wells were used to develop the potentiometric surface map provided as Figure 14. This figure illustrates potentiometric conditions within the uppermost aquifer, which is comprised of the unconsolidated sand and gravel unit and the underlying highly weathered sandstone.

During December of 1997, groundwater flow within the uppermost aquifer was generally to the east, although a slight flow component to the east-northeast toward Village Creek was evident. Based on December 14, 1997 data, the horizontal hydraulic gradient was significantly greater beneath the MARCO property relative to downgradient areas. For example, the horizontal hydraulic gradient was approximately 0.03 feet/foot (ft/ft) between the western and eastern boundaries of the MARCO property, and approximately 0.002 ft/ft from the eastern property boundary to P-19. The average horizontal hydraulic gradient between mini-wells P-7 and P-19 was 0.02 ft/ft, which is equivalent to the slope of the bedrock surface between P-7 and P-19, suggesting that the groundwater flow regime within the uppermost aquifer is significantly influenced by bedrock topography. However, it should be noted that the Phase I water level data may not be indicative of seasonably variable potentiometric conditions.

5.3 Contaminant Characterization

5.3.1 Soil Contamination

Previous Investigative Results

As part of the 1986 KDHE investigation, two soil samples (MAS1 and M2), a sediment sample (MASD), and a sludge sample (MAS3) were collected from the approximate locations shown on Figure 2. Results of this sampling program are included in Appendix A. The 1987 report by KDHE concluded that soil contamination is present throughout the site.

Phase I Investigative Results

Soil samples were analyzed at 20 probe hole locations during Phase I investigative activities. The samples were collected from soil core material during direct push probing activities described in Section 3.2. Soil samples were analyzed for the parameters shown in Table 2. On-site soil screening analysis was conducted by HLI; these analytical results are provided in Appendix H. QA/QC duplicate analysis was conducted by Pace Analytical, with results provided in Appendix I. Contaminants detected during Phase I activities are summarized in Table 3.

TPH and BTEX compounds were the primary contaminants detected in soil samples downgradient of the MARCO facility. As illustrated by Figure 15, TPH contaminants were encountered in soils at P-3 (1.41 ppm), P-19 (4.67 ppm), P-2 (45.9 ppm), P-4 (163 ppm), and P-20 (243 ppm), based on samples taken directly above the water table. Isoconcentration contours provided on Figure 15 suggest that off-site TPH migration extends into the low-lying area directly downgradient of the MARCO site.

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During soil coring activities, petroleum compounds were visible throughout P-2 and P-4 core, although localized non-contaminated areas were evident as well. Contamination within P-20 soil core was visible from approximately 5 feet to 13 feet bgs. Contamination was visually identified by the "sheen" typical of petroleum products. PID readings and core odor were also used to determine zones of contamination. No visible contamination or odor was observed within soil core at probe holes P-3 and P-19.

The soil TPH contaminant plume trace depicted on Figure 15 extends downgradient of the site within a low-lying area that drains into wetlands to the east. The pathway seems to coincide with the historic MARCO facility railroad spur. Furthermore, the TPH plume trace mirrors the structural bedrock high suggested on Figure 13, indicating that some type of structural control, natural or man-made, could have influences TPH migration from the MARCO facility. Historic soil TPH contaminant levels recorded during installation of monitor wells MW-1 through MW-8 (Geraghty and Miller, 1996) were not included in the construction of Figure 15, since they likely are partially indicative of contamination from Total Service Station.

Soil BTEX concentrations are provided on Figure 16. Total BTEX soil concentrations were measured in probe holes P-2 and P-4 at 102.3 ppb and 3987 ppb, respectively. Elevated soil BTEX concentrations downgradient from the MARCO facility are seemingly confined to the area near Santa Fe Avenue. However, soil field screening performed during installation of monitor wells MW-1 through MW-8 yielded significant benzene concentrations of up to 11,000 ppb (Geraghty and Miller 1996).

In addition to the TPH and BTEX compounds detected, elevated concentrations of naphthalene were detected at probe holes P-2 (495 ppb) and P-4 (6170 ppb) within screening samples (Table 3). A QA/QC duplicate sample at probe hole P-14 yielded a naphthalene concentration of 130 ppb, although the screening sample for that location was

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characterized as non-detect. The soil sample at probe hole P-7 yielded a chloroform concentration of 6.7 ppb.

Pace duplicate samples taken at probe holes P-7, P-14, and P-18 yielded chloromethane concentrations of 440 ppb, 420 ppb, and 400 ppb, respectively. A chloromethane concentration of 530 ppb was detected in the Pace method blank, indicating that the contaminant was lab induced.

5.3.2 Groundwater Contamination

Previous Investigative Results

As part of the 1986 KDHE investigation of the MARCO site, seven site vicinity wells were sampled, including four wells installed by KDHE (M1 through M4). Groundwater sampling locations are shown on Figure 2. Results of this sampling program, which are included in Appendix A, are summarized below.

Well M1 - This well, which is located near the eastern (downgradient) boundary of the MARCO site, indicated the most significant groundwater contamination at the site. Groundwater sampling of well M1 was initially performed on November 6, 1986, resulting in a total VOC concentration of 219.9 parts per billion (ppb). Because of the relatively high contaminant concentrations measured in the initial sample, well M1 was resampled on January 29, 1987, resulting in a total VOC concentration of 563.2 ppb. BTEX concentrations in the second sample were 520.0 ppb benzene, 11.7 ppb toluene, 1.0 ppb ethylbenzene, and 29.0 ppb total xylene. Other notable detection's in the second sample include phenol at 10.2 ppb, 2-methylnapthalene at 15.5 ppb, and bis (2-ethylhexyl) phthalate at 28.1 ppb. It is reported that M1 was also sampled in 1990, resulting in 1000 ppb benzene, 40.8 ppb toluene, 62.5 ppb ethylbenzene, and 16.4 ppb total xylene (Geraghty & Miller 1996).

Well M2 - This well was installed immediately east of the site (downgradient), although this well no longer exists. VOCs were not

detected in the M2 sample, although di-n-octyl phthalate was measured at 29.5 ppb and phenol was measured at 3.0 ppb.

Well M3 - This well is located near the northeast corner of the site. VOCs were not detected in the M3 sample, although di-n-octyl phthalate was measured at 96.3 ppb and bis (2-ethylhexyl) phthalate was measured at 12.9 ppb.

Well M4 - This well is located immediately east of the BS Pit. VOCs were not detected in the M4 sample, although di-n-octyl phthalate was measured at 135 ppb.

Larkin Well - This upgradient well is located west of the site (Figure 3). No priority pollutants were measured in this well, which is 101 feet deep.

Ash Grove Well - This 22-foot deep well, which was located between the MARCO site and Village Creek, no longer exists. VOCs were not detected in this well, although di-n-octyl phthalate was measured at 175 ppb.

Fairway Crude (FC) Well - This 12.7-foot deep well, which was located near the northwest corner of the MARCO site, apparently no longer exists. The only priority pollutant measured in this well was benzene at 0.9 ppb.

It was concluded that groundwater contamination had occurred beneath the MARCO facility, and that the contaminated groundwater plume was migrating to the east-southeast (KDHE 1987). The contaminated groundwater plume included refined petroleum products (BTEX compounds) and was apparently located above the unnamed member of the Chanute Shale.

Supplemental groundwater sampling of wells M1, M3, and M4 was performed by KDHE on May 2, 1996. As noted in Appendix B-2, grab samples were collected for analysis of priority pollutant VOCs. BTEX concentrations in the M1 sample were 296 ppb benzene, 31.3 ppb toluene, and 21.0 ppb total xylene. VOCs were not detected in the M3 and M4 samples.

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Pertinent groundwater quality data are also available (Geraghty & Miller 1996) from monitor wells installed near the current Total Service Station located near the southeast corner of the MARCO site (Figure 2). September 1995 BTEX concentrations in these wells included 4,490 ppb at MW-7, 36.6 ppb at MW-2, 22.7 ppb at MW-6, and 7.9 ppb at MW-3. BTEX concentrations were not detected in the other wells sampled. Groundwater sampling of these same wells in July 1997 resulted in BTEX concentrations of 2,700 ppb at MW-7, 37 ppb at MW-6, 13 ppb at MW-3, and 1 ppb at MW-1 (Terracon 1997a). Groundwater sampling of these wells in September 1997 (Appendix B-1) resulted in BTEX concentrations of 3,980 ppb at MW-7, 27 ppb at MW-6, 59 ppb at MW-3, and 1 ppb at MW-1 and MW-8 (Terracon 1997b). The 1997 sampling events suggest that BTEX concentrations measured in these wells are likely attributable to the MARCO site, since BTEX concentrations were noted upgradient from the Total Service Station and downgradient from the MARCO site.

Phase I Investigative Results

Groundwater samples were analyzed at 20 probe hole locations during Phase I investigative activities. The samples were collected from groundwater following direct push coring activities using the methodology described in Section 3.2. Groundwater samples were analyzed for the parameters shown in Table 2. On-site groundwater screening analysis was conducted by HLI; these analytical results are provided in Appendix H. QA/QC duplicate analysis was conducted by Pace Analytical, with results provided in Appendix I. Contaminants detected during Phase I activities are summarized in Table 3. Results of Phase I groundwater sampling activities are described below.

P-4 - This downgradient mini-well, located near the southeast corner of the MARCO property, yielded the most significant off-site groundwater contamination. The December 1997 groundwater screening sample for this well resulted in BTEX concentrations of 645 ppb benzene, 367 ppb toluene,

- 148 ppb ethylbenzene, and 150 ppm total xylene. Other notable detections included naphthalene at 202 ppb and TPH at 1.73 ppm.
- P-2 This mini-well was installed immediately downgradient of the MARCO site and approximately 450 feet north of P-4. The groundwater screening sample for this well resulted in BTEX concentrations of 16.8 ppb benzene, 9.08 ppb toluene, and 7.24 ppb ethylbenzene. Other notable detections included naphthalene at 18.9 ppb, 1,2-dichloroethane at 4.85 ppb, and TPH at 0.55 ppm. A QA/QC duplicate sample was collected from P-2 for off-site analysis. The duplicate sample did not report detections of naphthalene or TPH. Additionally, chlorobenzene and 1,2-dichlorobenzene were detected in the duplicate sample at 2.5 ppm and 2.6 ppm, respectively.
- **P-20** This probe hole was located downgradient of the site approximately 170 feet east of abandoned KDHE monitor well M2. The groundwater screening sample for this probe hole resulted in a TPH concentration of 1.68 ppm. A QA/QC duplicate sample collected from P-20 yielded VOC concentrations of chlorobenzene (0.71 ppb), 1,2-dichlorobenzene (2.2 ppb), and 1,4-dichlorobenzene (1.1 ppb).
- M1 This KDHE monitor well, which is located on the MARCO property near the eastern boundary, has historically contained the most significant groundwater contamination on the MARCO site. The December 1997 groundwater screening sample for this well resulted in BTEX concentrations of 372 ppb benzene and 19.6 ppb toluene. Groundwater screening for KDHE monitor wells M3 and M4 resulted in no detections for the constituents listed in Table 2.
- P-5 This probe hole was located south of the MARCO site and approximately 150 feet west of Terracon well MW-3. The groundwater screening sample for this probe hole resulted in BTEX concentrations of 12 ppb benzene, 15.1 ppb toluene, and 2.18 ppb ethylbenzene.
- P-7 This mini-well was installed upgradient of the MARCO property and south of the EOTT building. Groundwater screening and duplicate samples for this well resulted in detected chloroform concentrations of 3.2 ppb and 1.4 ppb, respectively.
- **P-9** This mini-well was installed upgradient of the MARCO site near the northwest corner of the property. The groundwater screening sample for this well resulted in a chloroform concentration of 1.2 ppb.
- **P-11** This probe hole was located north of the MARCO site on Ash Grove Cement Company property. The groundwater screening sample for this probe hole resulted in a TPH concentration of 0.56 ppm.

P-12 - This mini-well is located northeast of the intersection of Santa Fe Avenue and Ash Grove Road, near the Ash Grove Cement Company railroad spur. The groundwater screening sample for this well resulted in a detected chloroform concentration of 4 ppb.

No other contaminants were detected in Phase I groundwater samples.

Site-vicinity groundwater TPH concentrations are presented on Figure 17. TPH compounds were detected at probe holes P-2 (0.55 ppm), P-4 (1.73 ppm), P-11 (0.56 ppm), P-20 (1.68 ppm), and KDHE monitoring well M1 (0.39 ppm). Groundwater TPH isoconcentration contours delineate an area similar to the soil TPH isoconcentration map (Figure 15). Groundwater TPH concentration contours also suggest that contamination extends north of the MARCO property in the vicinity of probe hole P-11. This northern extension of TPH contaminants could be attributed to a northeast trending groundwater flow component from the MARCO site.

BTEX compounds are the major groundwater contaminants detected during the Phase I investigation. Phase I probe hole groundwater quality data were combined with available data from monitor wells MW-1 through MW-8 (Terracon 1997a and 1997b) installed near the current Total Service Station located near the southeast corner of the MARCO site.

Groundwater total BTEX isoconcentration contours are provided on Figure 18. Terracon monitor well water quality data collected September 9, 1997 included BTEX concentrations of 3980 ppb at MW-7, 59 ppb at MW-3, 27 ppb at MW-6, 1 ppb at MW-2, and 1 ppb at MW-8. Phase I investigative probe hole locations yielded BTEX concentrations of 1310 ppb at P-4, 33.1 ppb at P-2, 29.3 ppb at P-5, and 391.6 ppb at KDHE monitor well M1.

Figure 18 suggests that BTEX contaminants are mainly confined to the southeast corner of the site. BTEX contaminants detected at probe holes P-5 and P-4, which are upgradient

and cross-gradient from the Total Service Station, support the results of previous sampling events suggesting that the noted BTEX contamination originates from the MARCO site. Groundwater isoconcentration maps for individual BTEX compounds benzene, toluene, ethylbenzene, and total xylene are presented as Figures 19, 20, 21, and 22, respectively. These isoconcentration maps suggest groundwater contamination occurrence and conclusions similar to those noted for BTEX.

Groundwater naphthalene isoconcentration contours are provided on Figure 23. Terracon monitor well water quality data collected September 9, 1997 included naphthalene concentrations of 320 ppb at MW-7, 6.6 ppb at MW-3, and 1.6 ppb at MW-6. Phase I investigative probe hole locations yielded naphthalene concentrations of 202 ppb at P-4 and 18.9 ppb at P-2 although, the Pace duplicate sample at P-2 was non-detect for naphthalene. In addition, while the groundwater screening sample at P-14 was non-detect for naphthalene, the Pace duplicate sample for P-14 resulted in a naphthalene concentration of 130 ppb.

Naphthalene isoconcentration contours indicate that this contaminant is confined to the southeast corner of the site, similar to BTEX compounds. The detection of naphthalene in the P-14 duplicate sample (130 ppb) however, suggests that the contaminant possibly extends beyond the downgradient migration of other aromatic VOCs.

Although Phase I groundwater screening samples yielded no detections of MTBE, Terracon monitor well water quality data collected September 9, 1997 included MTBE concentrations of 15 ppb at MW-2, and 1.4 ppb at MW-5. These MTBE detections are attributed to the Total Service Station since MTBE was not used as a gasoline additive until after MARCO operations were discontinued.

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Other contaminants detected in Phase I groundwater samples include chloroform and 1,2-dichlorobenzene. Groundwater screening samples resulted in chloroform concentrations of 3.2 ppb at P-7, 1.2 ppb at P-9, and 4.0 ppb at P-12. The remaining sample points were non-detect. 1,2-dichlorobenzene was detected in Pace duplicate samples yielding concentrations of 2.6 ppb at P-2 and 1.1 ppb at P-20. Groundwater screening samples for P-2 and P-20 were non-detect for the 1,2-dichlorobenzene.

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6.0 CONCLUSIONS

Phase I of a Comprehensive Investigation of off-site soil and groundwater contamination was conducted near the MARCO site in Chanute, Kansas during December of 1997. Since the U.S. EPA is responsible for investigation of contamination at the MARCO property, the focus of the Phase I investigation was characterization of off-site contamination. Based on results of the surface water sampling performed by KDHE in 1986 and the groundwater emphasis for the MARCO CI, surface water quality sampling was not performed as part of the Phase I investigation. Major findings of Phase I investigations performed in the vicinity of the MARCO site are as follows.

Hydrogeologic Model

- 1. The most significant laterally extensive hydrostratigraphic units in the site-vicinity are a silty clay stratum, the underlying sand and gravel unit, and the Cottage Grove Sandstone Member of the Chanute Shale.
- 2. Although not present at the upgradient probe hole locations to the west of the MARCO facility, the silty clay unit is approximately 20 feet thick in the eastern portion of the study area. This relatively low permeability silty clay unit tends to function as an aquitard beneath and downgradient from the MARCO property.
- 3. Underlying the silty clay aquitard is a relatively high permeability zone primarily comprised of sand and cherty gravel. This sand and gravel unit was generally about 0.5 to 2 feet thick where penetrated by Phase I boreholes. The upper portion of this granular unit is characterized as a silty sand or a clayey sand, while the lower portion of the unit is commonly a silty gravel or a clayey gravel. Groundwater within the sand and gravel is typically present under semi-confined conditions; potentiometric levels in the vicinity of the Phase I mini-wells were typically 2 to 3 feet bgs.
- 4. Phase I investigative probe holes were typically terminated at refusal within the Cottage Grove Sandstone. Bedrock intervals penetrated during Phase I are characterized as highly weathered, fine to medium grained, very weak sandstone. The upper portion of this sandstone unit

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is inferred to be relatively permeable. Shale was only encountered in one of the Phase I probe holes. Beneath the MARCO site, the bedrock surface slopes to northeast at approximately 0.05 ft/ft, and slopes to the east at 0.01 ft/ft in the area east of the site.

- 5. In addition to the major hydrostratigraphic units that are laterally extensive in the site-vicinity, a surficial sand was encountered near the southeast corner of the MARCO property. Where present, this silty to clayey sand unit typically extends from approximately 1 to 4 feet bgs. Groundwater within this surficial sand is generally present under unconfined conditions.
- 6. The uppermost aquifer that is laterally continuous in the site-vicinity is the relatively high permeability unit that is comprised of the sand and gravel stratum and the upper portion of the Cottage Grove Sandstone. The combined thickness of the uppermost aquifer beneath the site is estimated to range from 2 to 5 feet. Groundwater within the uppermost aquifer is typically present under semi-confined conditions.

Groundwater Flow Regime

- 7. Consistent with previous results, December 1997 potentiometric monitoring indicates that groundwater flow within the uppermost aquifer was generally to the east, although a flow component to the east-northeast was also suggested. Seasonal influences may result in variations in the groundwater flow direction.
- 8. The horizontal hydraulic gradient beneath the MARCO property was about 0.03 ft/ft, but was considerably less (0.002 ft/ft) east of the site. The overall horizontal hydraulic gradient across the study area was 0.02 ft/ft, which is equivalent of the slope of the bedrock surface, suggesting that the groundwater flow regime within the uppermost aquifer is significantly influence by bedrock topography.
- 9. Depth-discrete potentiometric data have not been collected to date, so conclusions can not be made concerning vertical directions and gradients between the various hydrostratigraphic units.

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Extent of Soil Contamination

- 10. Previous investigations by KDHE concluded that soil contamination was present throughout the MARCO property. The most significant contaminants encountered off-site from the MARCO property during the Phase I investigations were TPH, BTEX compounds, and napthalene.
- 11. A TPH concentration of 243 ppm was detected in probe hole P-20, located approximately 200 feet east of Santa Fe Avenue. Petroleum contamination within the P-20 soil cores was visible between depths of 5 to 13 feet bgs. In addition, a TPH value of 5 ppm was measured approximately 800 feet east of Santa Fe Avenue. TPH soil contamination coincides with the historic MARCO facility railroad spur, which could have provided a high permeability pathway for migration of petroleum compounds. The noted TPH soil contamination also correlates with a structural high in the bedrock surface, although the effect of this geologic feature is not known.
- 12. Total BTEX concentrations of up to 3,987 ppb (probe hole P-4) were measured in soil samples collected immediately downgradient from the MARCO site. High concentrations of napthalene were similarly restricted to soil sampling areas located immediately east of Santa Fe Avenue, with a maximum value of 6,170 ppb at probe hole P-4.

Extent of Groundwater Contamination

13. Previous investigations by KDHE concluded that groundwater contamination had occurred beneath the MARCO facility, and that the contaminated groundwater plume was generally migrating to the east-southeast. In addition, investigations in the vicinity of the Total Service Station concluded that BTEX concentrations measured in monitor wells located near the southeast corner of the MARCO site were likely attributable to groundwater contamination migrating from the MARCO facility. Finally, a landowner located immediately east of the MARCO property reported that several excavations located east of Santa Fe Avenue resulted in observation of contaminated groundwater within approximately 6 feet of the ground surface. Results of the Phase I investigation are generally consistent with these observations and conclusions.

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- 14. Off-site groundwater contamination identified downgradient of the MARCO facility primarily consisted of TPH, BTEX compounds, and naphthalene. Additionally, minor detections of chloroform, chlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, and 1,2-dichloroethane were observed downgradient of the site.
- 15. TPH contaminated groundwater extended approximately 500 feet downgradient of the MARCO site boundary. The groundwater TPH plume mirrors the soil TPH contamination. Groundwater TPH concentrations ranged from 0.55 ppm at P-2 to 1.73 ppm at P-4. Furthermore, TPH contamination extends north of the site where groundwater concentrations of 0.56 ppm were detected at P-11.
- 16. Groundwater BTEX contamination is confined to an area immediately downgradient of the site near the southeast corner of the MARCO facility. Total BTEX concentrations ranged from 33.1 ppb at P-2 to 1310 ppb at P-4.
- 17. Naphthalene contamination is apparently also confined to the southeast corner of the MARCO site. Groundwater concentrations ranged from 18.9 ppb at P-2 to 202 ppb at P-4. A duplicate sample detection of 130 ppb at P-14 suggests that napthalene is present at a high concentration at a distance of over 400 feet east of Santa Fe Avenue.
- 18. Groundwater monitoring at P-18 and P-19 indicates that residual impacts from the 1989 hazardous chemical spill are not apparent.
- 19. Buried utilities in the vicinity of the MARCO facility may have provided a pathway for migration of groundwater contaminants, however available data are not sufficient to support a definitive conclusion.
- 20. Domestic water well users are not located in the area of contamination downgradient from the MARCO property. Current data support the conclusion that the MARCO site does not pose an immediate threat to private drinking water supplies. Although the City of Chanute's municipal water supply is located downgradient from the site, the MARCO groundwater plume apparently does not extend within 1 mile of the water supply intake.

Data collected from the historical evaluation and the Phase I investigation suggest that the following corrective action alternatives should be evaluated during the Corrective Action Study. Items that merit consideration in connection with the potential corrective action alternatives are also noted.

Alternative #1 - No Further Action

Since the U.S. EPA is responsible for investigation and remediation of contamination within the boundaries of the MARCO property, contaminant source areas within the facility have not been evaluated as part of this investigation. Corrective action measures that are ultimately implemented by the U.S. EPA to address contamination within the MARCO facility may eventually remove or mitigate the source areas that are contributing to off-site contamination. This possible scenario could make no further action by KDHE a reasonable alternative.

Alternative #2 - Remediation of Uppermost Aquifer

Remediation of the uppermost aquifer would focus on the upper, highly weathered sandstone unit and the sand and gravel unit that directly overlies bedrock at the site. Contaminants of most significant concern would include VOCs such as benzene and napthalene, which are present in off-site groundwater in concentrations above the MCLs. Remediation of the uppermost aquifer could also involve petroleum hydrocarbons that are present in downgradient areas. As described below, remedial technologies implemented could include: 1) bioremediation technologies such as ORC injection, SORC wells, biosparging, and biochemical enhancement; 2) construction of treatment walls; or 3) groundwater extraction and treatment.

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Alternative #3 - Remediation of Uppermost Aquifer and Surficial Sand

The surficial sand present near the southeast corner of the MARCO facility is apparently not laterally extensive, yet could serve as a significant ongoing source of off-site contamination. Withdrawal of contaminated groundwater from the uppermost aquifer would induce relatively steep downward vertical gradients from the surficial sand to the uppermost aquifer. Depending on the integrity of the intervening silty clay aquitard, the effectiveness of remedial activities in the uppermost aquifer could be compromised by migration of contaminants from the overlying surficial sand. Therefore, the Corrective Action Study should also consider remediation of the surficial sand unit.

Based on current data, the surficial sand unit (where present) typically extends from approximately 1 foot bgs to 4 feet bgs. Because of its shallow occurrence, trenching could be considered in connection with interception and/or remediation of this contaminated flow zone. However, it should be noted that buried utility lines are abundant immediately downgradient from the MARCO facility, thereby making trenching operations problematic. Potential remedial technologies that could be used in connection with the corrective action alternatives described above include the following.

Bioremediation

Oxygen Release Compound Injection - Oxygen Release Compounds (ORC*) could be injected into the saturated zone using direct push methods. ORC* is a formulation of magnesium peroxide that slowly releases molecular oxygen when hydrated. This oxygen promotes microbial growth and maximizes the ability of aerobic microbes to degrade contaminants such as petroleum hydrocarbons. As the microbes degrade contaminants, carbon dioxide and water remain as reaction products. ORC* comes in powder form and typically is mixed into a 30 percent solid slurry for injection purposes and provides enough of the compound to release over an approximate 6-month period. Prior to the introduction of ORC*, specific groundwater analytical parameter concentrations should be identified to

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determine proper remedial design. Therefore, groundwater sampling and analysis of strategic sample points would be required prior to ORC* injection.

Slow Oxygen Release Compound (SORC) Wells - Magnesium peroxide or calcium peroxide compounds can be placed into wells, providing similar results to the ORC injection process described above. With the SORC wells, the SORC compounds are placed into "socks," which are linked and lowered into a well. The rate of oxygen release using this material is slow enough that the socks only have to be changed every 6 months to a year.

Biosparging - Biosparging is a process that injects air into the aquifer to strip organic compounds from the saturated soils. Injected air then flows to the vadose zone, where a bioventing system is designed to create optimum colonies of bacteria that consume contaminants in the air stream. Air injection results in an increase of the dissolved oxygen content of groundwater, which in turn allows populations of naturally occurring bacteria to multiply and degrade compounds within the aquifer.

Biochemical Enhancement - The control of inorganic nutrients is critical to establishing and maintaining the activity of bacteria. Bacteria require both nitrogen and phosphorous to carry out cellular functions. Depending on conditions downgradient from the MARCO facility, it may be necessary to enhance the activity of bioremediation through the addition of nutrients. Phosphate and nitrogen based nutrient feeds can be injected into target zones to stimulate and maintain the remedial process.

Treatment Walls

Treatment walls or reactive barriers are permeable walls constructed with a treatment material or structure placed across the path of a contaminant plume. The wall can be used to create chemical or biochemical reactions or may facilitate a process that removes the contaminant. They can be installed with trenching where the contaminant is shallow, or by injection through vertical or horizontal wells. Materials which are typically used for these reactive barriers include nutrient compounds, zero valence iron, and activated carbon.

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Groundwater Extraction and Treatment

Groundwater can be removed from the ground and treated at the surface utilizing conventional methods of wastewater treatment. Groundwater extraction downgradient from the MARCO site would involve pumping a series of vertical wells to provide the required capture of contaminants. The extracted groundwater would be routed through a conventional treatment system. Several technologies that may be evaluated include air stripping, liquid phase carbon adsorption or ozone destruction. The treated water would then be discharged to a receiving water body, passed to a publicly owned wastewater treatment plant for further treatment and dilution, or reinjected into the ground.

The potential corrective actions described above focus on groundwater remediation instead of remediation of off-site contaminated soils. This groundwater focus is based on the assumption that the most contaminated soils are present within the MARCO facility, and will be addressed through a U.S. EPA corrective action. Focusing on remediation of off-site contaminated groundwater was also driven by the assumption that off-site soil remediation would be relatively costly, and would involve more significant disruption of utilities and the operations of downgradient landowners. These assumptions will be further evaluated as part of the Corrective Action Study.

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8.0 RECOMMENDATIONS

As described in the MARCO CI Work Plan (Golder 1997), a phased approach was envisioned for investigation of migration of contaminants off-site from the MARCO facility. Based on the results of Phase I, and data gaps that should be filled in support of the Corrective Action Study, we recommend that the following activities be performed as Phase II of the MARCO CI.

- 1. Well Installation in the Uppermost Aquifer We recommend that two wells be installed in the area of maximum groundwater contamination immediately southeast of the MARCO property. The wells would be screened in the sand and gravel and highly weathered bedrock unit that comprises the laterally continuous uppermost aquifer beneath the site. We recommend that the wells be installed within approximately 100 feet of existing wells P-4 and MW-7. These wells would be 2-inch or 4-inch diameter, depending on hydraulic test considerations and the potential usefulness of these wells as withdrawal or injection points in connection with remediation of the uppermost aquifer. Drilling performed in connection with this well installation will also allow collection of undisturbed samples of the silty clay aquitard, and laboratory testing to determine the vertical hydraulic conductivity of this unit.
- 2. Well Installation in the Deeper Bedrock We recommend that one deeper well be installed near MW-7, in the area of maximum groundwater contamination. To prevent introduction of a possible pathway for migration of contaminants from the uppermost aquifer to a lower flow zone, the borehole would be sealed through the uppermost aquifer prior to coring approximately 15 feet into relatively competent rock. This deeper monitoring point would allow: 1) characterization of the bedrock interval that could function as an aquitard to downward migration of contaminants; 2) screening and monitoring of the strata present below the highly weathered bedrock; 3) evaluation of the vertical gradient between the uppermost aquifer and the deeper strata; 4) evaluation of the vertical extent of groundwater contamination; and 5) evaluation of the degree of hydraulic connection between the uppermost aquifer and the deeper bedrock, as indicated by the hydraulic testing program described below.

- determination of the rate of migration of the contaminant plume located near the southeast corner of the MARCO site; 2) allow evaluation of the hydraulic interconnection between the uppermost aquifer, the deeper bedrock flow zone, and the surficial sand unit that is present in this portion of the site; and 3) support potential remedial design activities.
- 4. Supplemental Probe Holes We recommend that supplemental direct push probing be performed downgradient from the MARCO site to allow: 1) further delineation of the lateral and vertical extent of the surficial sand unit noted near P-4 and MW-7; 2) groundwater screening of this surficial groundwater flow zone; 3) installation of temporary mini-wells in this surficial sand to determine the hydraulic response of this flow zone to pumping of the underlying uppermost aquifer; 4) additional characterization of subsurface conditions between the MARCO facility and the railroad bed located downgradient from the site; and 5) collection of data that would support potential remedial design activities for the surficial sand unit.
- 5. Groundwater Monitoring The conclusions provided herein are largely based on the groundwater monitoring event performed in December 1997. Instead of basing the subsequent corrective action evaluation on a single sampling event, we recommend that Phase II include an additional groundwater monitoring event to allow confirmation of the December 1997 water quality results. Supplemental groundwater sampling would also allow monitoring for parameters such as BOD, COD, dissolved oxygen, nitrate, iron (II), sulfate, sulfide, Eh, pH, total organic carbon, alkalinity, and chloride; information on these parameters would be useful in preliminary evaluation of the correction action alternatives and potential remedial technologies described in Section 7. To allow partial evaluation of seasonal variations in the groundwater flow regime, the Phase II monitoring event would also include comprehensive measurement of water levels in site-vicinity wells. Finally, the Phase II field program would include carbon treatment of contaminated groundwater collected during the Phase I and II investigations.

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This general description of the recommended Phase II scope of work is submitted to KDHE for purposes of discussion. Based on KDHE review of the Phase I results, we would like to discuss with you the Phase II scope of work that would best satisfy KDHE expectations for the project. Following KDHE/Golder agreement on the level of effort that is appropriate for Phase II, we will prepare a cost estimate for the scope of work agreed upon.

GOLDER ASSOCIATES INC.



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 N. Santa Fe, Chanute, Kansas. Submitted by Terracon Environmental, Inc. to KDHE on November 10, 1997.
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		w.

TABLES

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TABLE 1

MONITOR WELL CONSTRUCTION SUMMARY

			Elevatio	ıtion			Screened Interval	Interval			Sau	Sandpack Interval	erval
	Location	ion	Top of	Ground	Depth (fbgs)	(fbgs)	Screen	Eleva	Elevation	Riser	Elevation	tion	Sandpack
Monitor Well	Northing	Easting	PVC	Surface	Bottom	Top	Length	Bottom	Top	Diameter	Bottom	Top	Material
p-2	2623.00	104.00	914.79	914.7	21.05	11.05	01	893.65	903.65	1 in.	893.65	906	12-40 Grit
b-4	1848.00	47.00	914.83	914.9	21.87	11.87	01	893.03	903.03	- in	893.03	904.9	12-40 Grit
P-6	1630.00	-480.00	934.44	934.3	15.25	5.25	10	919.05	929.05	1 in.	919.05	931.3	12-40 Grit
p-7	2086.00	-1326.00	959.19	956.3	15.11	10.11	5	61.146	61.946	1 in.	941.19	950.3	12-40 Grit
6-d	2577.00	-1077.00	944.53	942.4	10.27	5.27	5	932.13	937.13	1 in.	932.13	939.4	12-40 Grit
P-10	2766.00	-722.00	927.79	927.6	14.55	4.55	10	913.05	923.05	1 in.	913.05	924.4	12-40 Grit
p-12	2951.00	222.00	913.99	913.8	21.16	11.16	10	892.64	902.64	1 in.	892.64	904.5	12-40 Grit
P-14	2041.00	476.00	914.92	914.2	24.55	14.55	10	889.65	\$9.668	1 in.	889.65	6.106	12-40 Grit
P-16	1534.00	271.00	914.18	914	21.87	11.87	10	892.13	902.13	1 in.	892.13	7(8	12-40 Grit
P-18	2375.00	775.00	915.52	911.3	20.68	10.68	01	890.62	900.62	l in.	890.62	903.1	12-40 Grit
61-d	2012.00	915.00	914.42	911.8	20.93	10.93	10	890.87	900.87	1 in.	890.87	902.8	12-40 Grit

Depth (bgs)

Survey data provided by Cornerstone Surveying

Locations based on the southeast corner of the appropriate sections

Elevations relative to National Geodetic Vertical Datum of 1929 (NGVD 1929) Elevations based upon U.S.C.& G.S. Benchmark "X245 1934"

All measurements provided in feet

PVC = Polyvinyl chloride casing, 1-inch ID schedule 40

Wells installed December 1997

Water level elevations measured December 14, 1997

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TABLE 2
PHASE I ANALYTE LIST

	Purgeable Halocarbons	
Bromodichloromethane	1,3-Dichlorobenzene	Methylene Chloride
Bromoform	1,4-Dichlorobenzene	1,1,2,2-Tetrachloroethane
Bromomethane	Dichlorodifluoromethane	Tetrachloroethene
Carbon Tetrachloride	1.1-Dichloroethane	1,1,1-Trichloroethane
Chlorobenzene	1,2-Dichloroethane	1,1,2-Trichloroethane
Chloroethane	1,1-Dichloroethene	Trichloroethene
Chloroform	trans-1,2-Dichloroethene	Trichlorofluoromethane
Chloromethane	1,2-Dichloropropane	Vinyl Chloride
Dibromochloromethane	cis-1,3-Dichloropropene	
1,2-Dichlorobenzene	trans-1,3-Dichloropropene	
	Purgeable Aromatics	
Benzene	Methyl tert-Butyl Ether	Toluene
Ethylbenzene	Naphthalene	Xylenes (o,m,p)

Note: Samples were also submitted for TPH analyses using Method OA-2.

			_

TABLE 3

SUMMARY OF DETECTED CONTAMINANTS

		National																					
		Primary Deicking Water	1-8-24	P2-W-1	P2-W-1D	P3-S-1	P4-S-1	P4-W-1	1-W-39	<u> </u>	_	PJ-W-1 PJ	P7-W-1D P9	P9-W-1 P1	P11-W-1 P	P12-W-1		P18-S-1D	<u> </u>	P20-S-1	P20-W-1	P20-W-1D	MI
ANALYTE	UNITS	Standards MCL	(5:6)				(3.6)			(e:n)	(6.1)	_					(2.5')	(2.5')	(3.0°)	(12.0')			KDHE
									-	-	-	-			-								
Halogenated and Aromatic VOCs							.									1							
Веплене	qdd	\$	ND	8.91	12	ND	624	(45	12	ND	ND	ND	QN	ON	GN	ON	QN	ND	ND	QN	QN	QN	372
Toluene	php	1000	17.9	80.6	2.9	ON	1340	367	15.1	ND	ON	ND	QN	ND	QN ON	QN	QN	QN	Q	Q.	QN	QN	9.61
Ethylberzere	qdd	7()()	40.2	7 24	GN	ON	673	148	2.18	ND	ND	ND	ND	ON	GN.	û	QN	QN	Q	Q.	Û.	ΩN	QN
(X) lene (total)	qdd	44()	44.2	ON	7.5	OIN	1350	150	ND	ND	ND	ON	ON	QN	QN	QN	QN	QN	QN	ΩÑ	Q.	S	GN
Total BTEX	hph	VN	102.3	33.12	22.4	ON	3987	1310	29.28	ON	ND	ND	ND	ND	ON.	QN	QN	QN	Q	û.	QN	Q.	391.6
Naphthalene	hph	143	495	18.9	GN	ND	6170	202	GN	ND	ND	ND	ND	ND	QN	GN	130	QN	QN	QN	QN	S.	QN
Chloroform	hph	VV	QN	CIN	ON	QN	OIN	ON	ND	6.7	ND	3.2	1.4	1.2	QN	4	GN	QN	QN	QN	QN	QN	QN
Chloromethane 1	hhh	\$	ON	ON	GN	GN	GN	ND	ND	OIN	440)	ND	ND	ND	ND	ON	420 1	1 004	QN.	QN	ON.	Q.	QN
Chlorobenzene	hh	100	ΩN	ND	2.5	QN	QN	OIN	ND	ND	ND	ND	ND	ND	ND	GN	QN	QN	Q.	QN	QN	0.71	QX
1.2-Dichlorobenzene	hph	9009	ND	QN	2.6	QN	ND	ND	ND	ND	ND	ND	ND	ND	ND	QN	GN	QN	ND	QN	QN	2.2	QN
1,4-Dichlorobenzene	php	7.5	ON	QN	QN	ON	OIN	ND	ND	ON	ND	ND	ND	ND	QN	QN	QN	QN	QN	QN	QN	Ξ	QN
1,2 Dichloroethane	hdd		ND	4.85	4.8	ND	ND	ND	ND	ND	ND	ND	QN	QN	QN	QN	QN	QN	QN	ND	QN	QN	QN
Total Petroleum Hydrocarbons																	1						
ТРН	ıudd	VN	45.9	755.0	ND	1.41	163	1.73	ND	2.63	ON	GN	QN	ND ON	0.566	GN	GN	ND	4.67	243	1.68	QN	QN.
NOTES:]

Soil Samples are Designated by "S" and are Accompanied by the Depth of Sample Collection

Water Samples are Designated by "W"

Duplicate Samples "D" were Analyzed Off-Site by Pace Analytical

ppb = parts per billion (µg/L-water; µg/kg-soil) ppm = parts per million (mg/L-water; mg/kg-soil)

summary Wells sampled by Golder in December 1997 are included in this detection

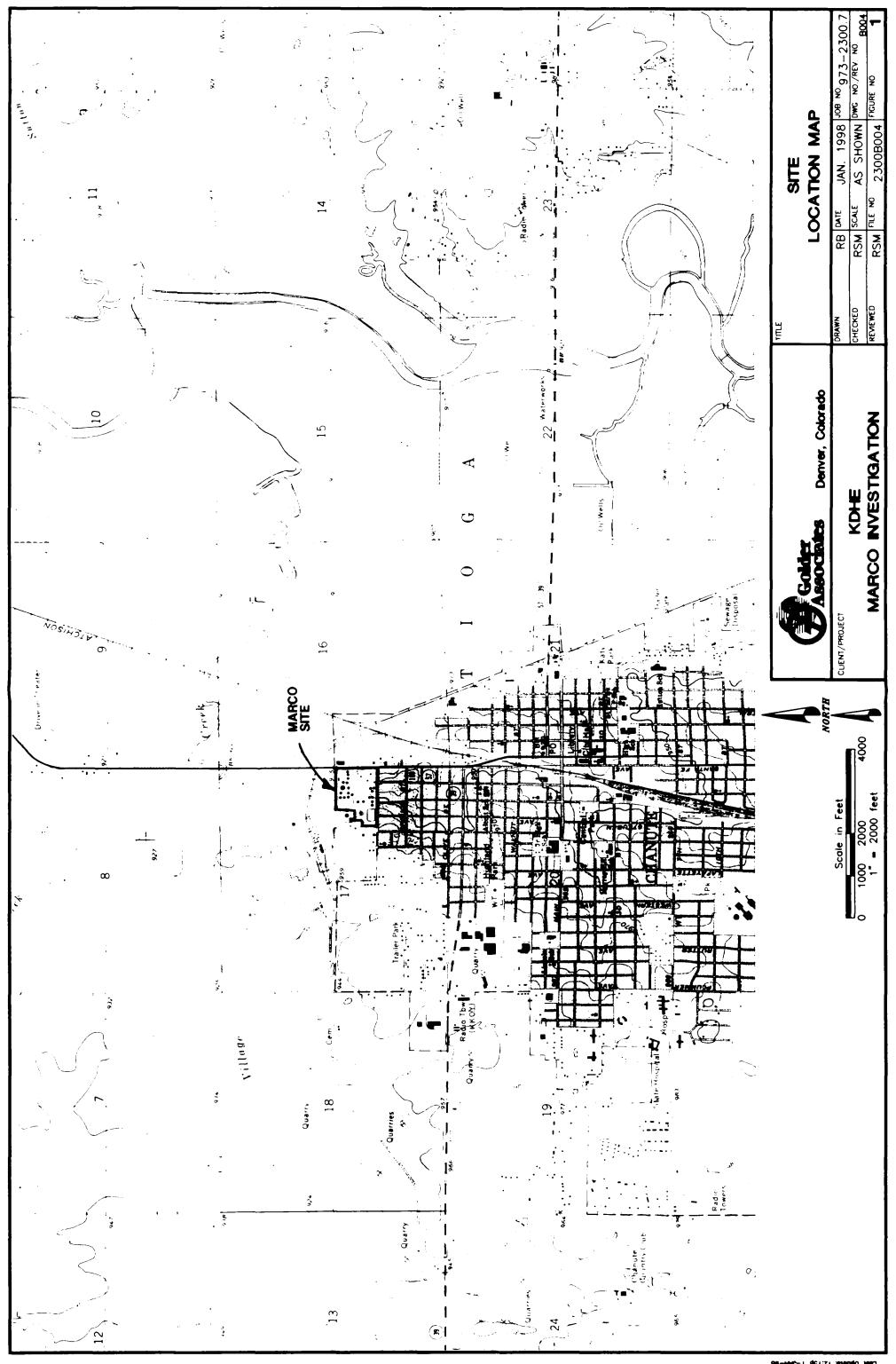
ND = Not Detected; Refer to Appendices H and I for Minimum Detection Limits No Std. = No standard
MCL = Maximum Concentration Limit, National Drinking Water Standards
NA = Not Available

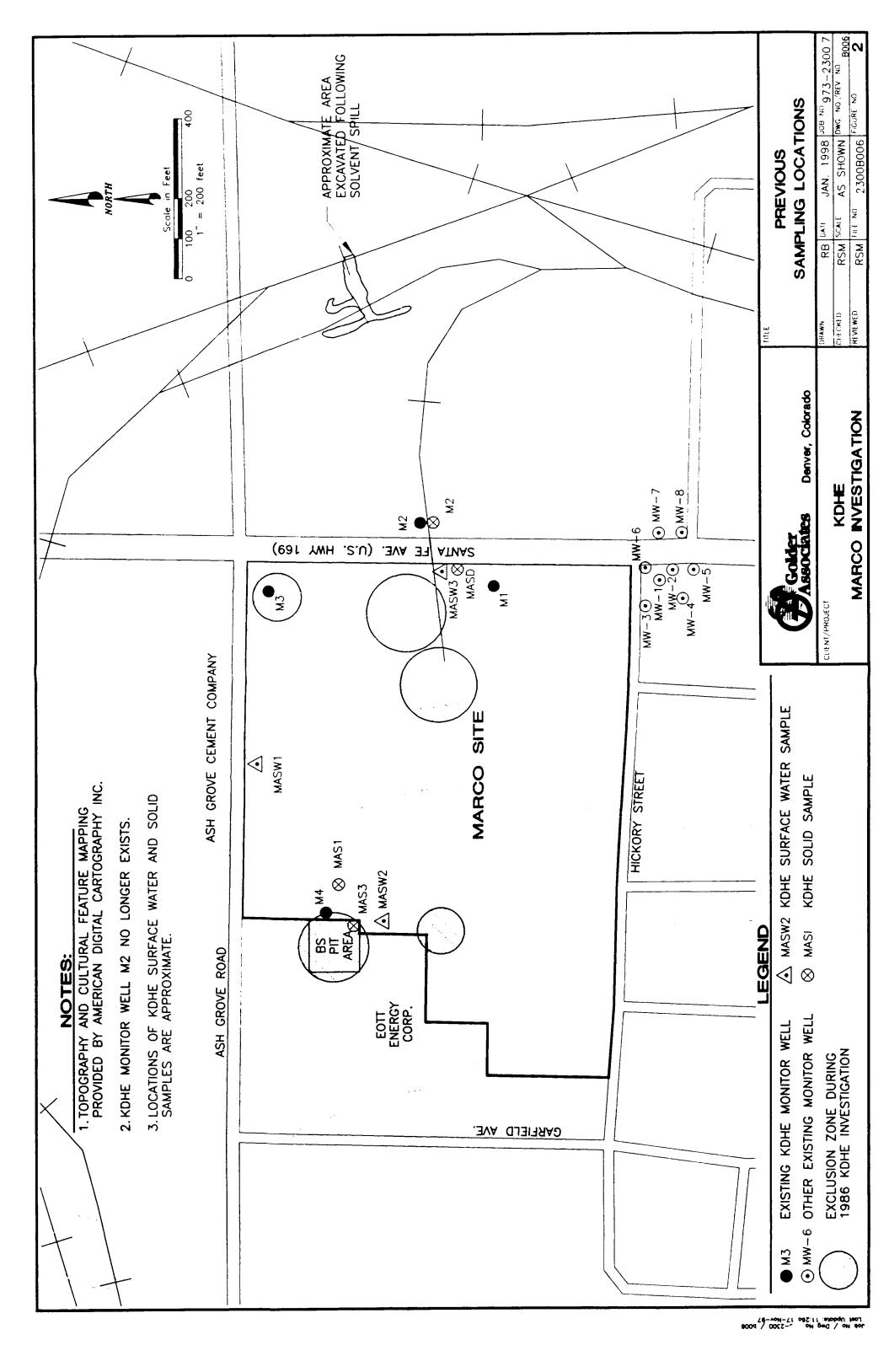
Chloromethane Corxentrations of 530 ppb were Detected in the Pace Analytical Method Blank

Golder Associates

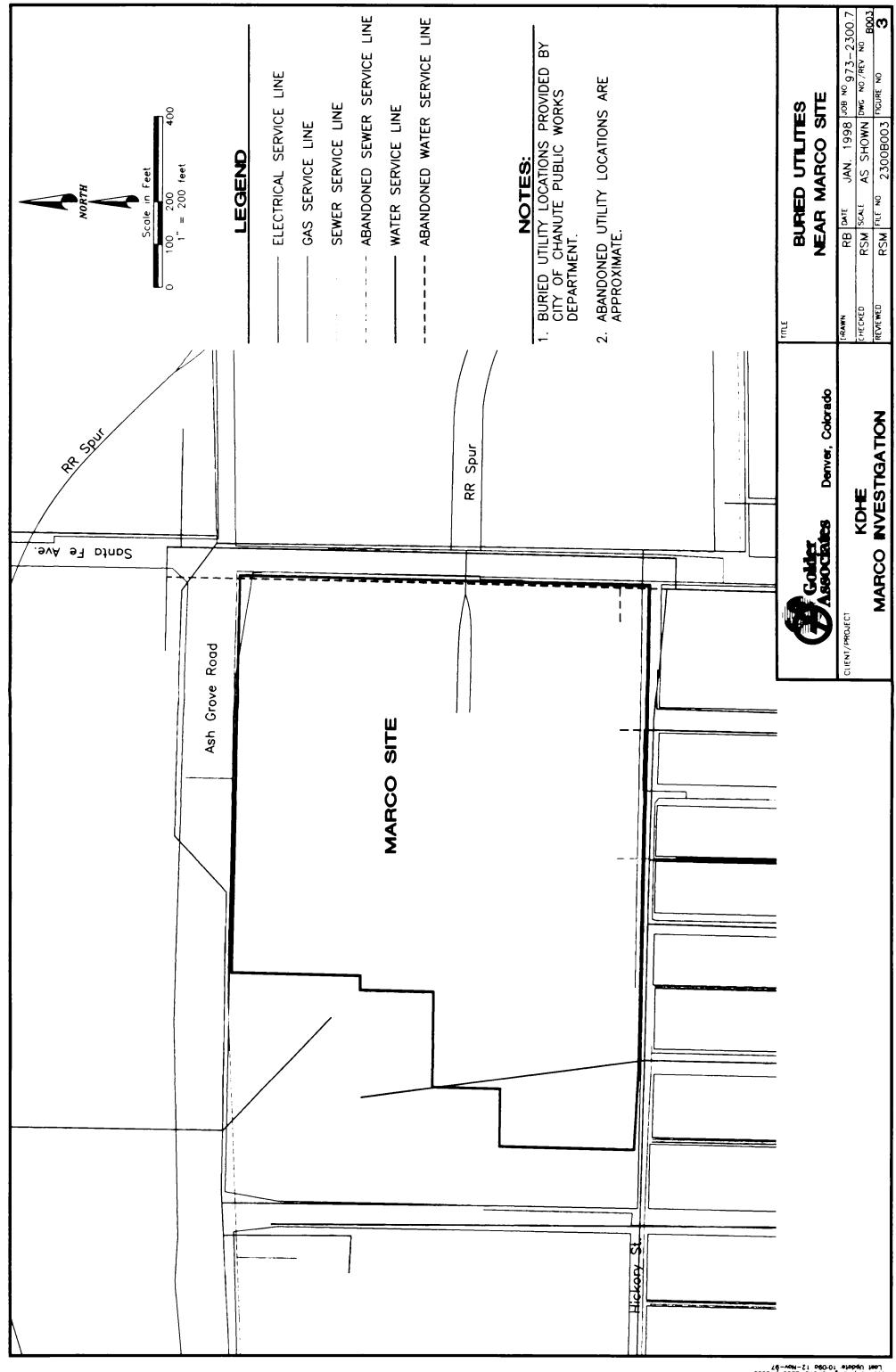
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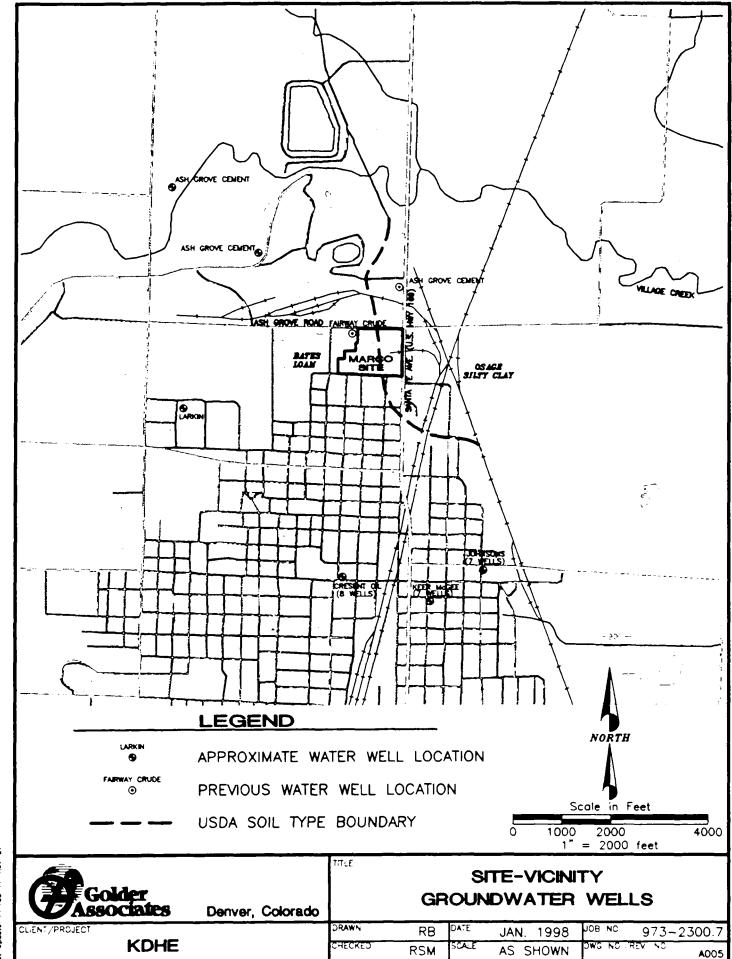








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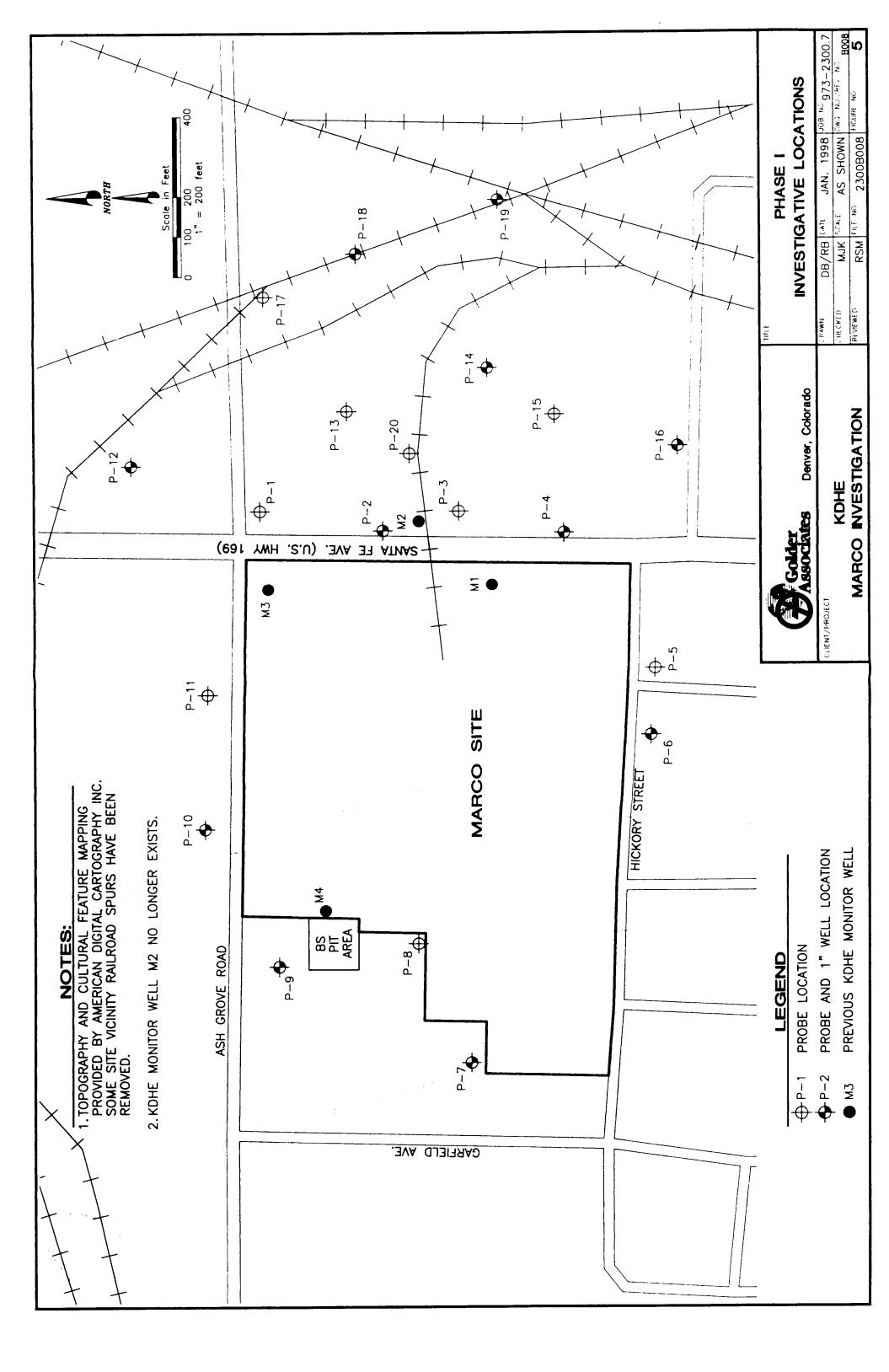
RSM

2300A005

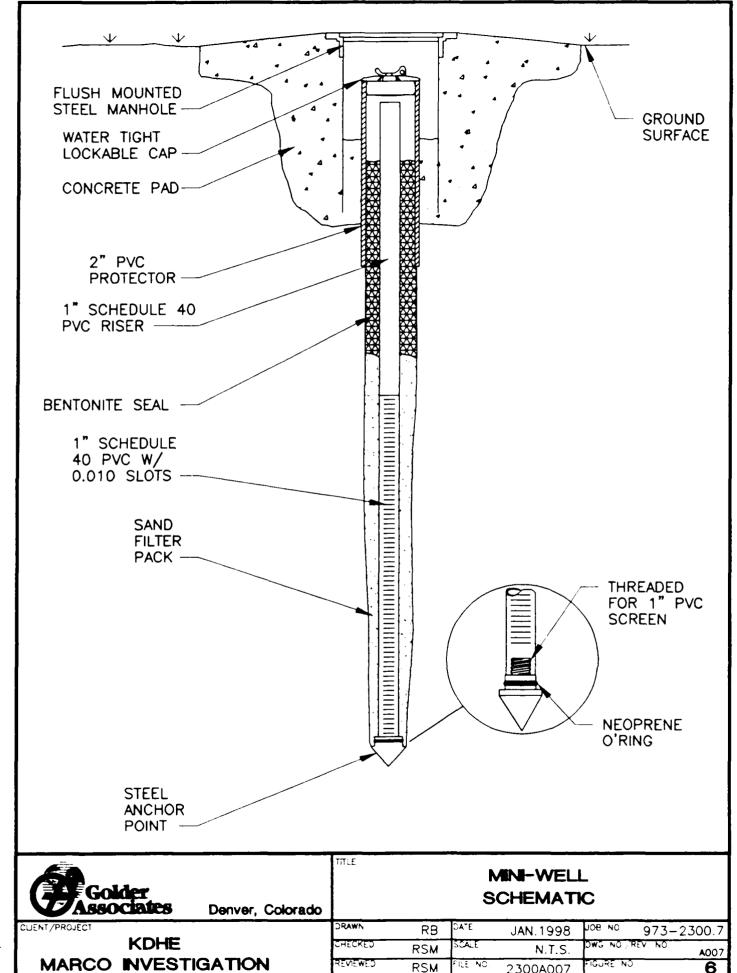
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MARCO INVESTIGATION

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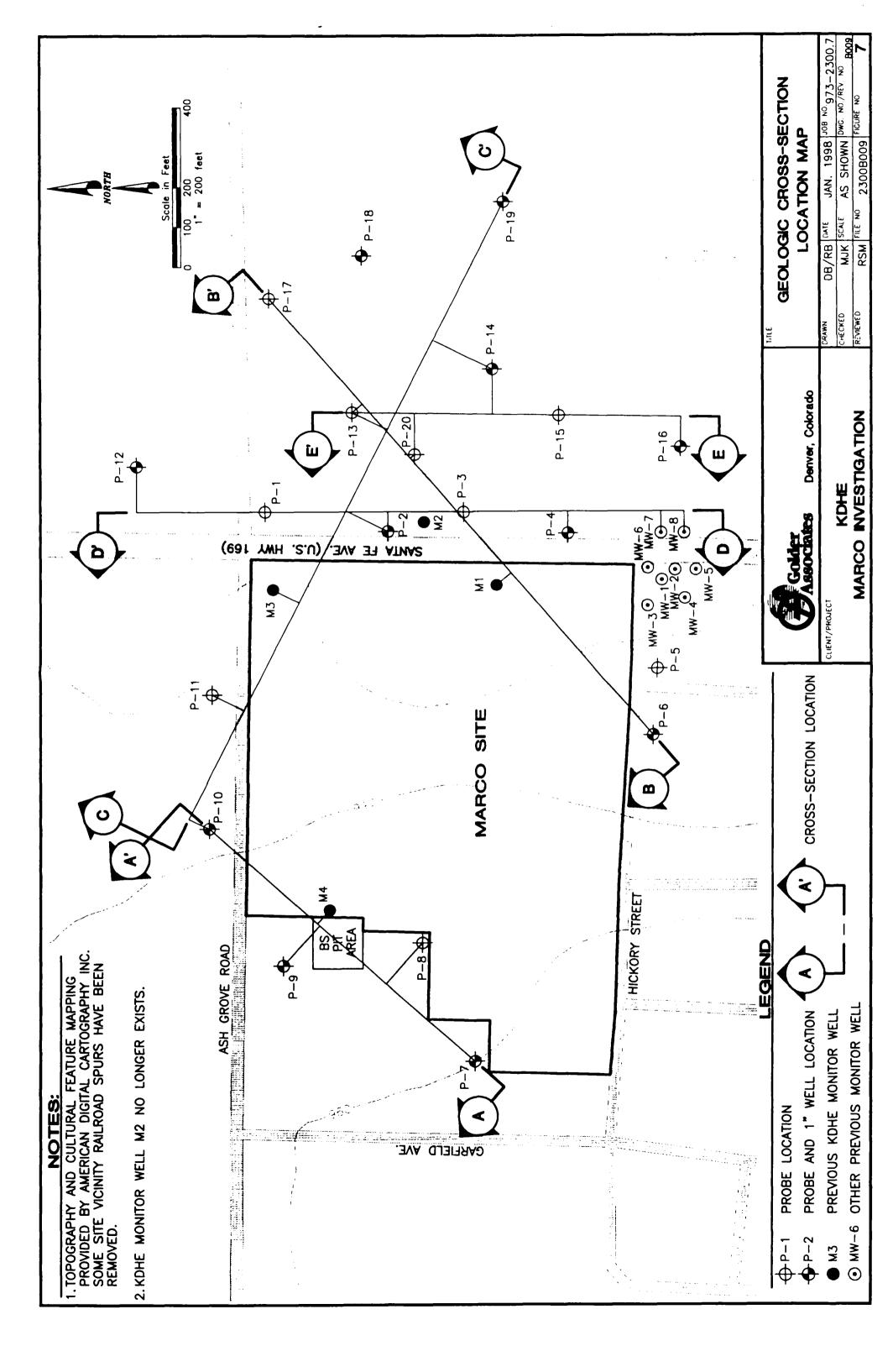
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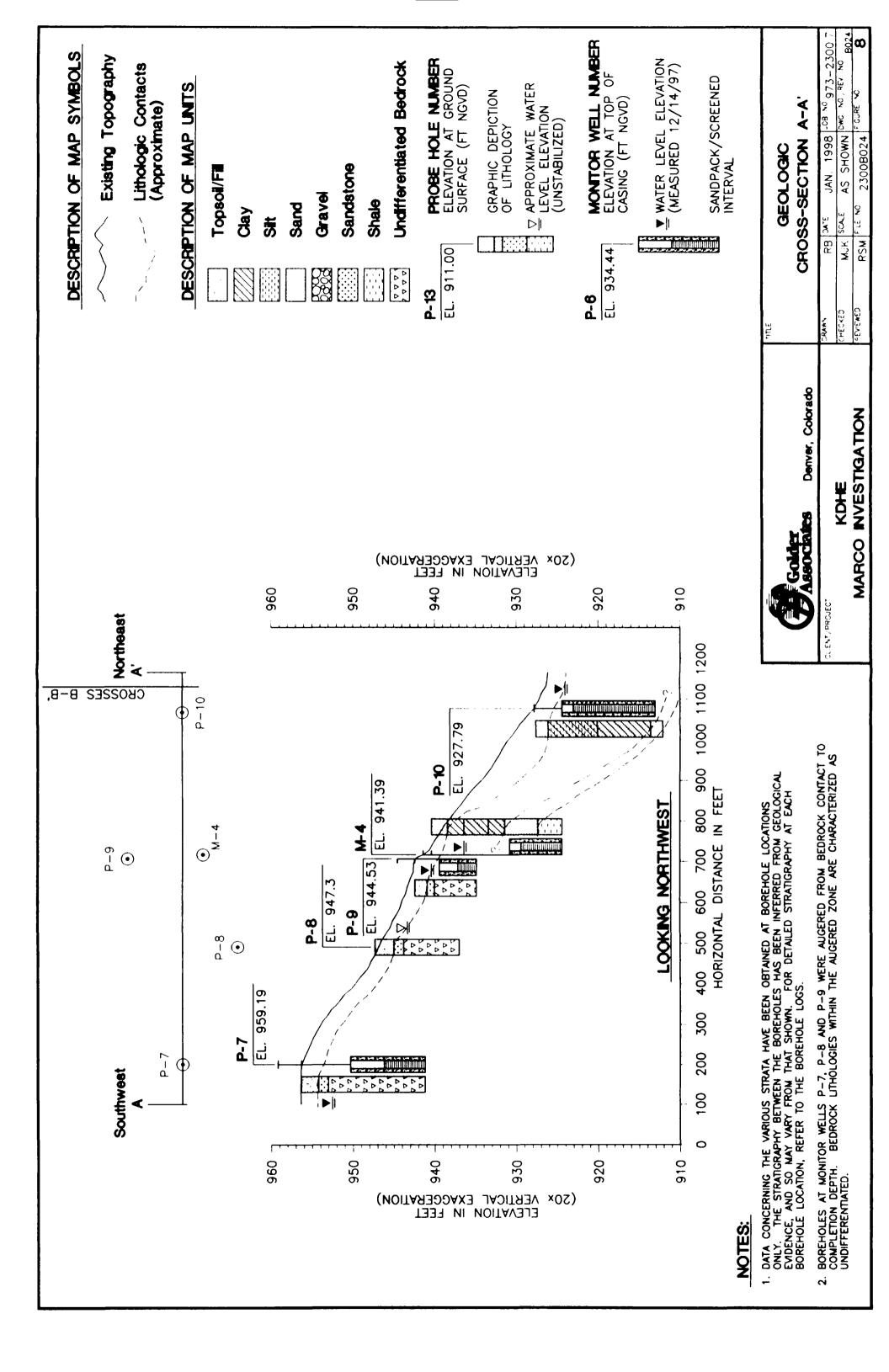


2300A007

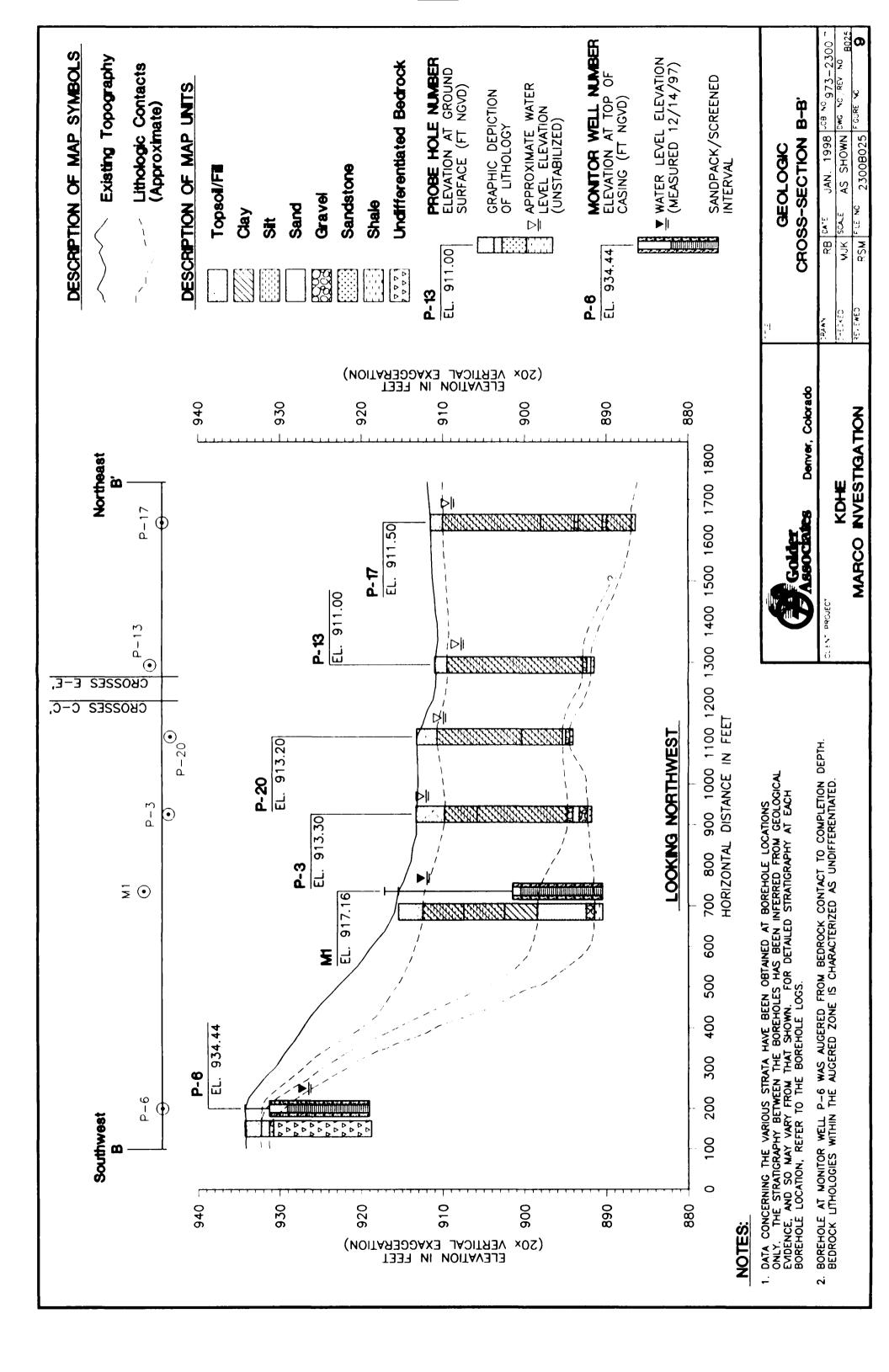
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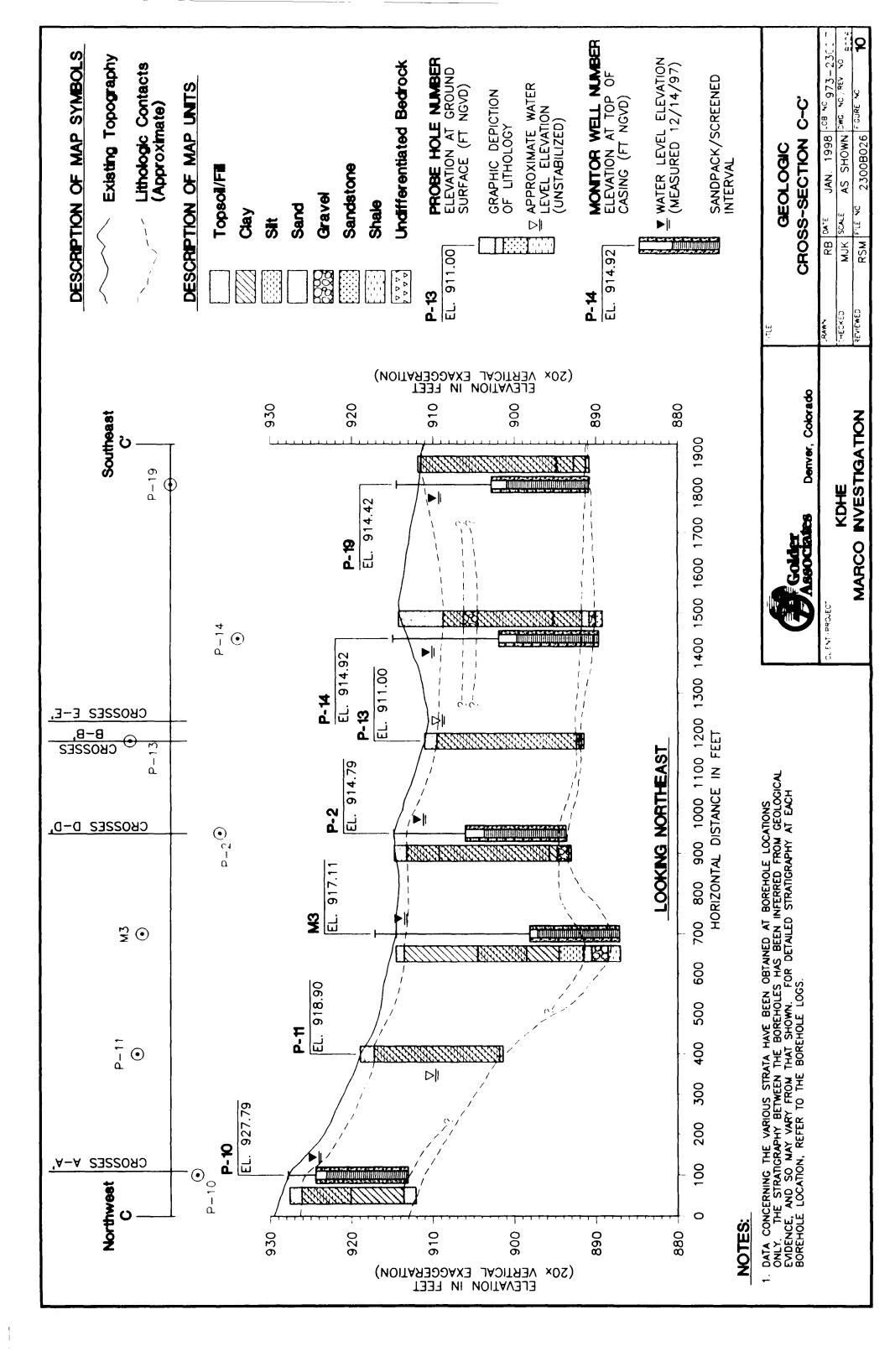
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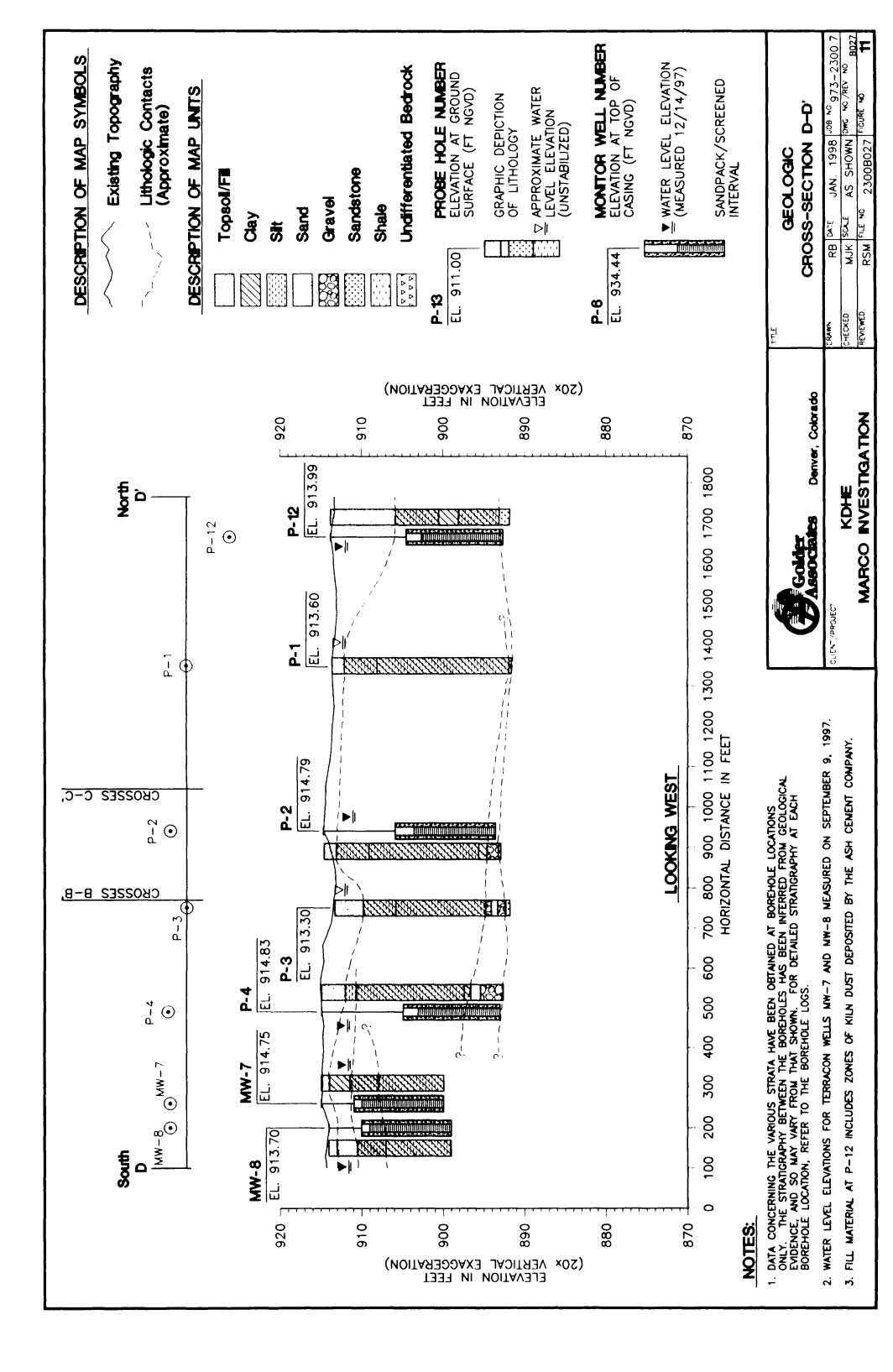


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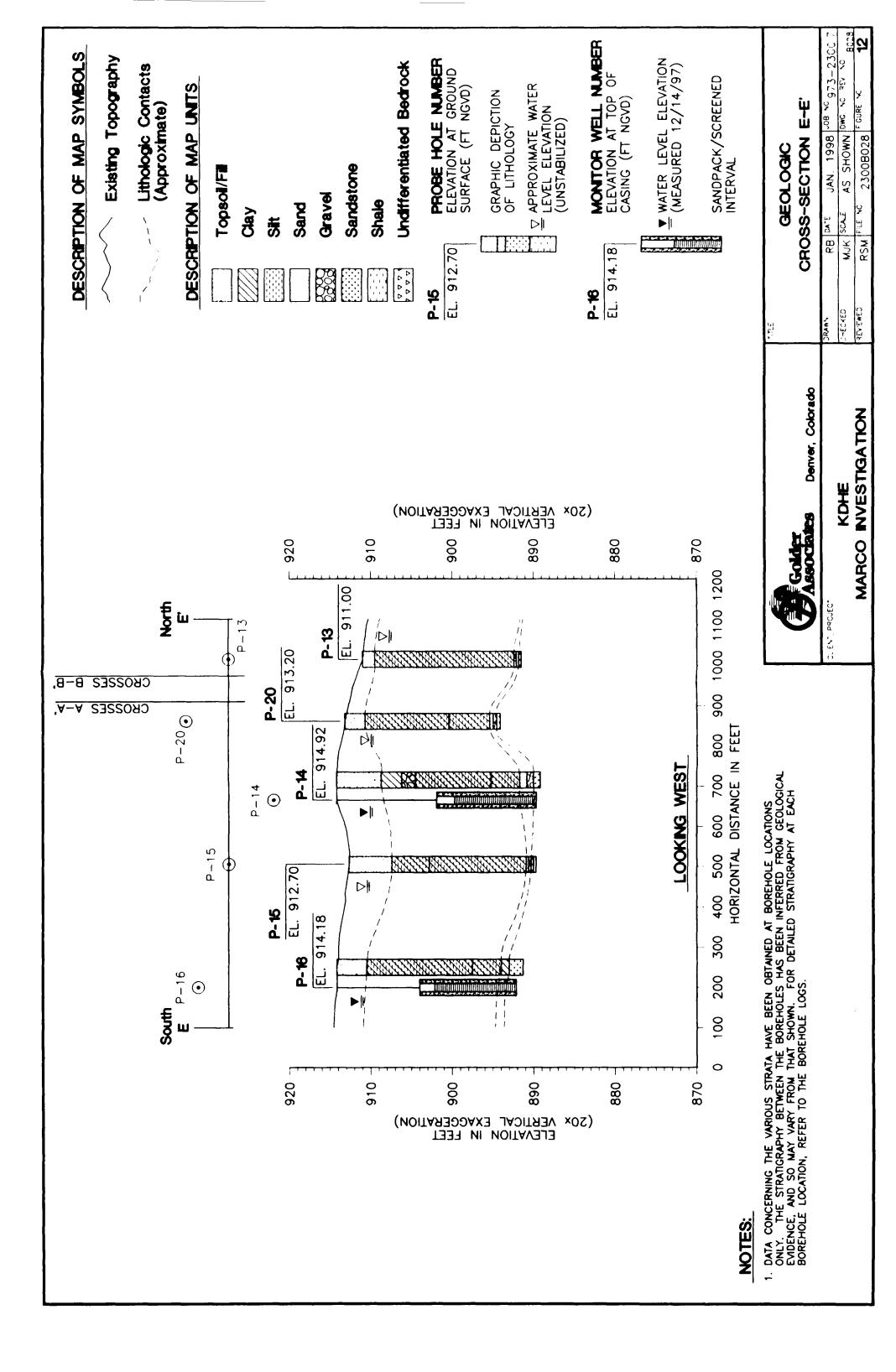


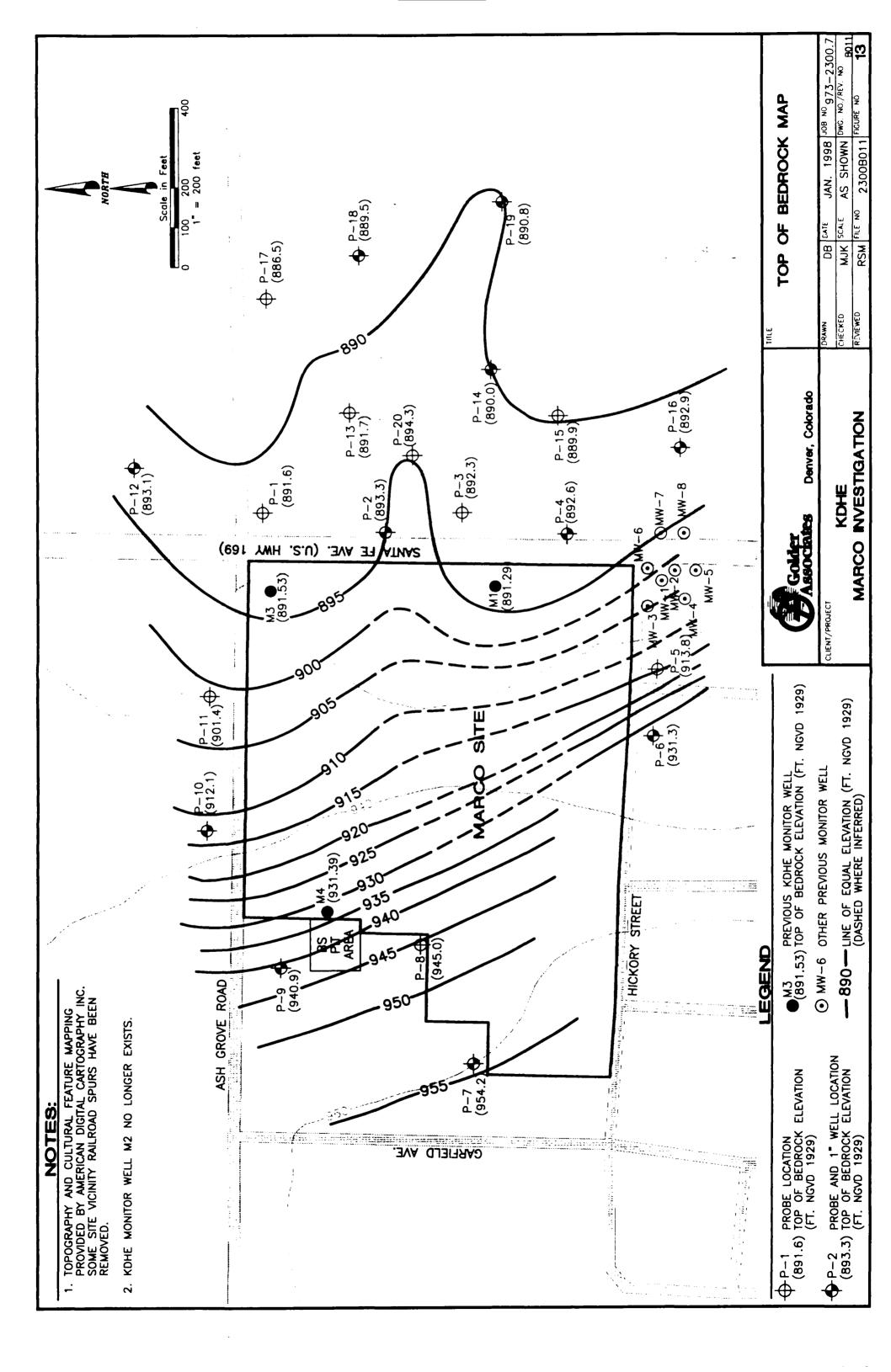


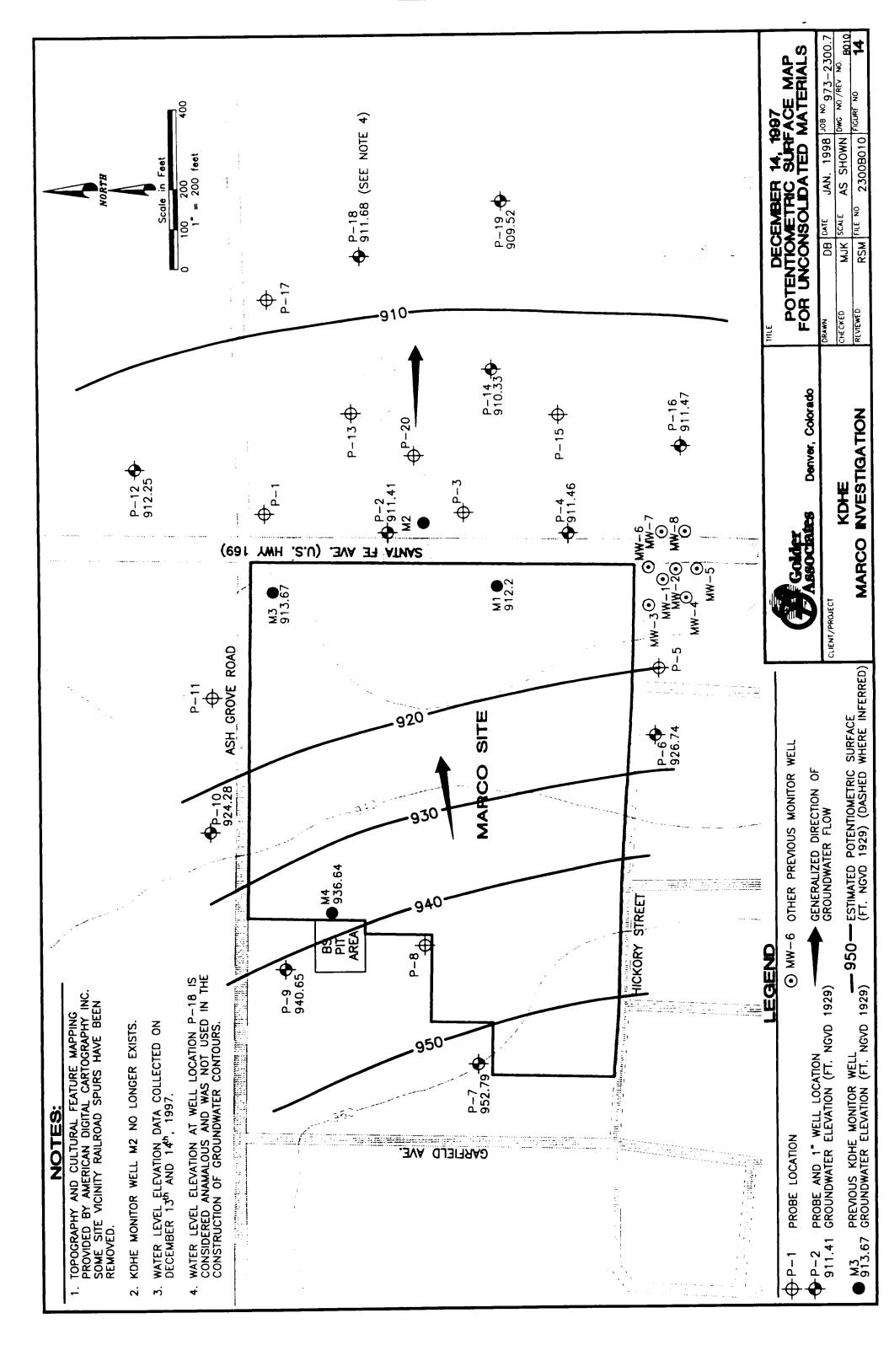
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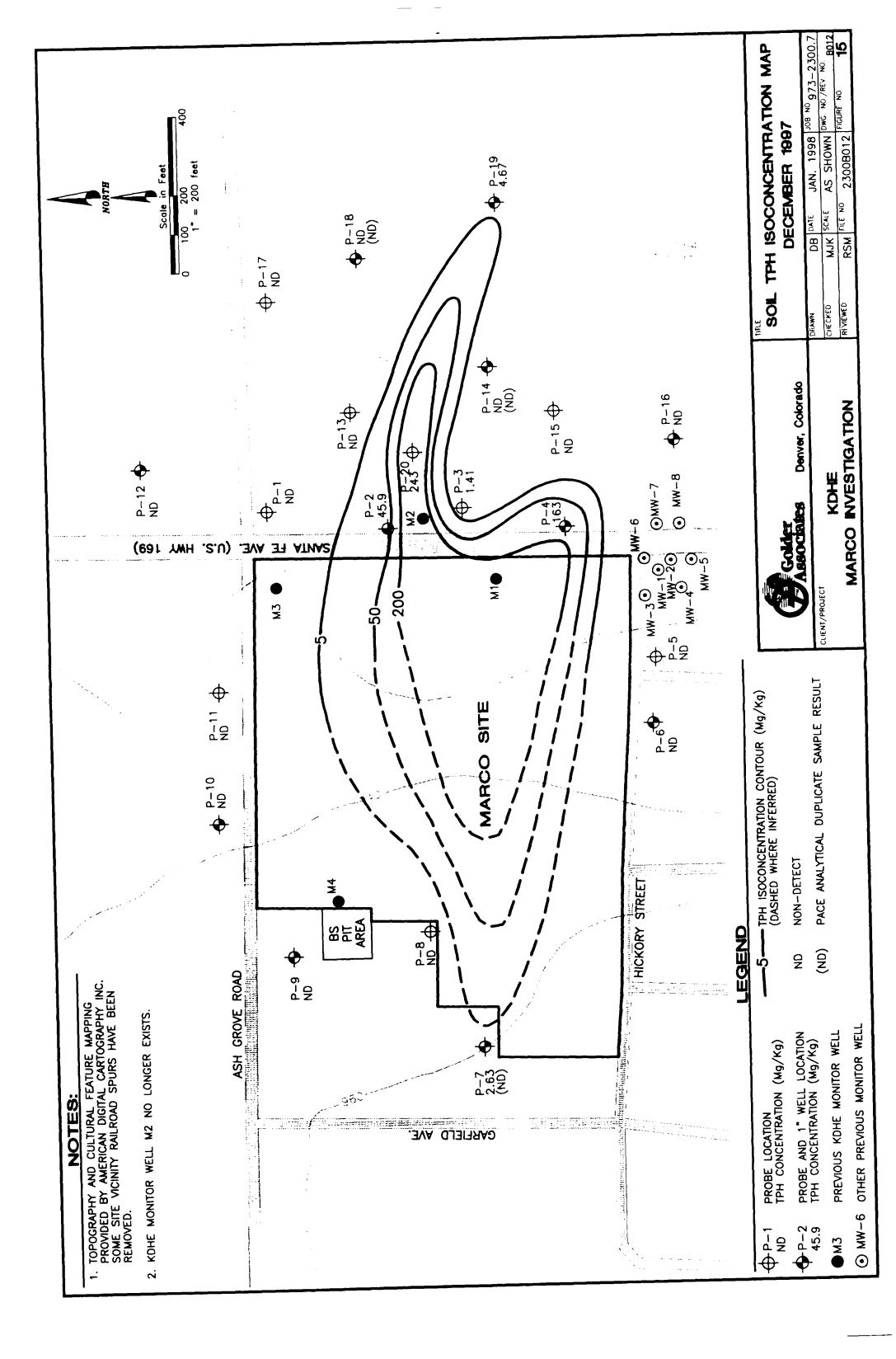


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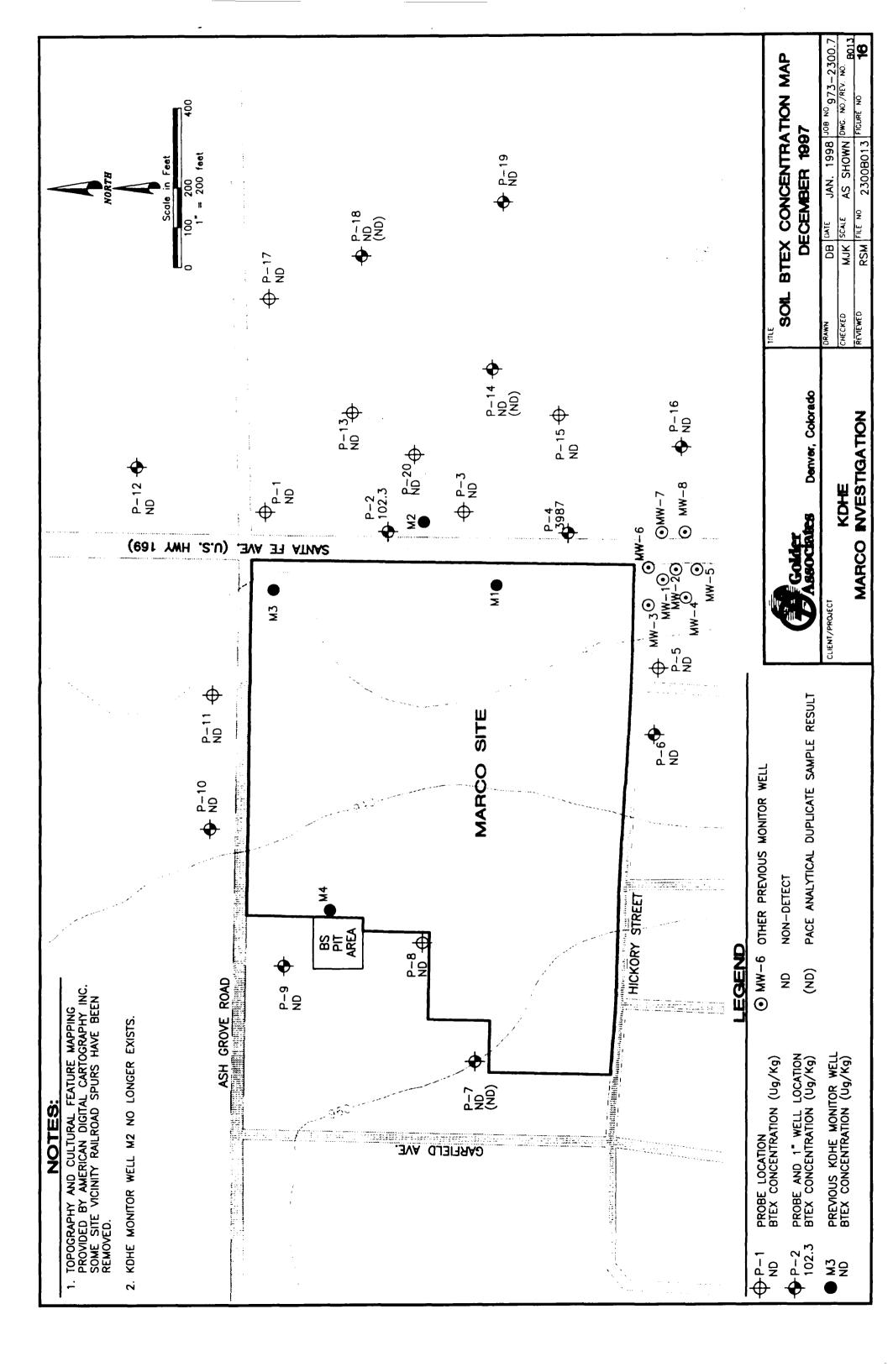


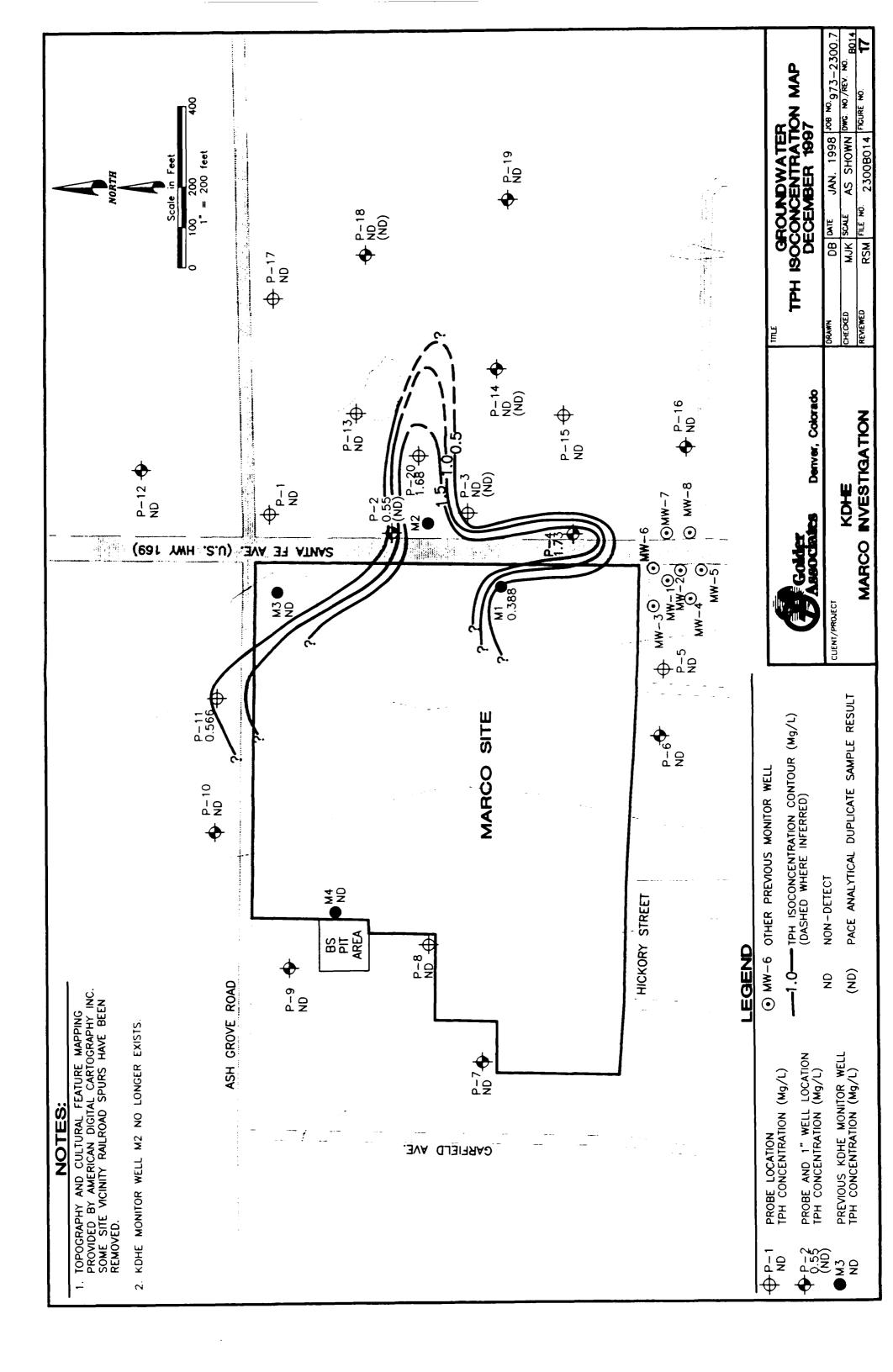




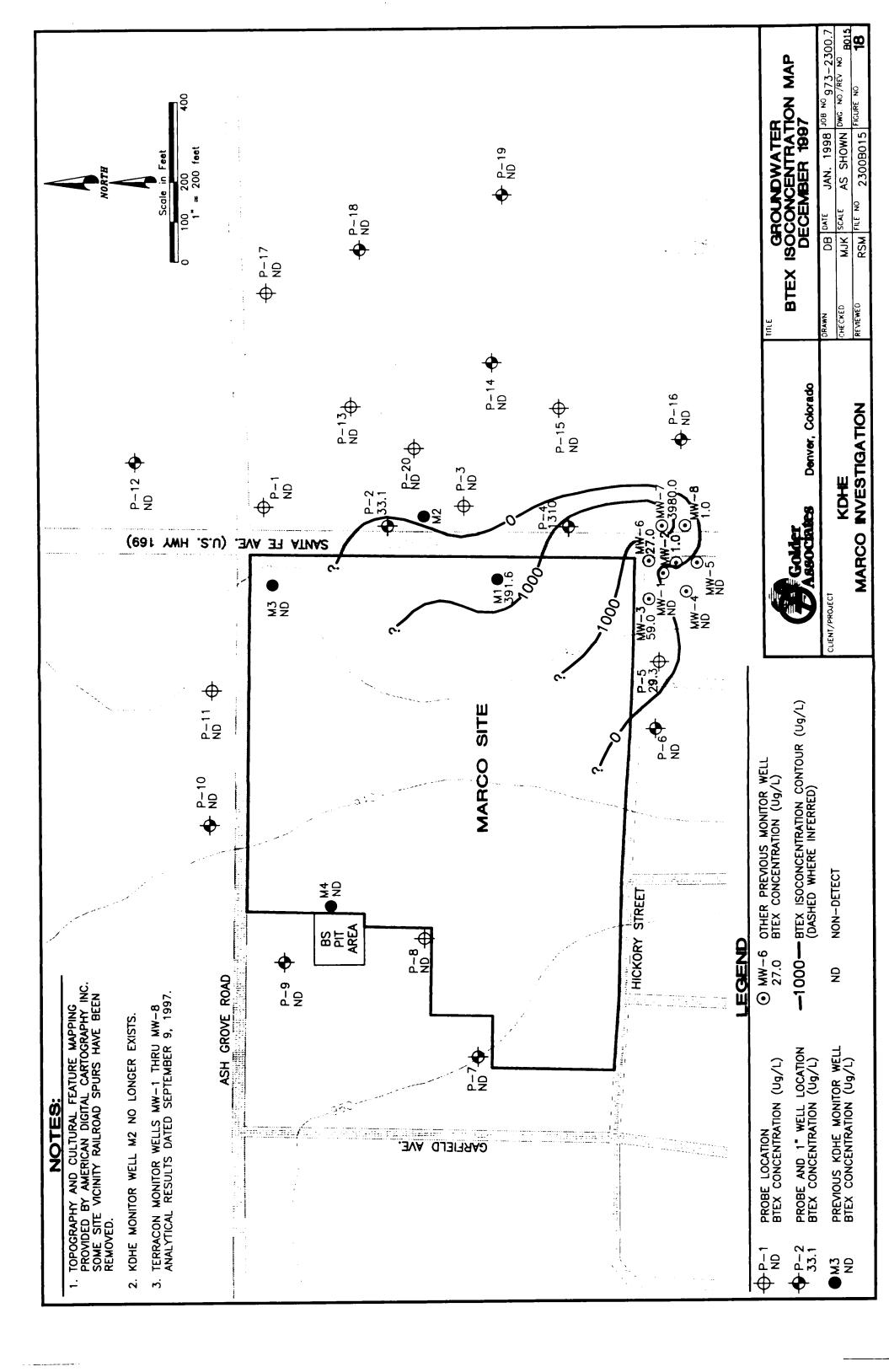


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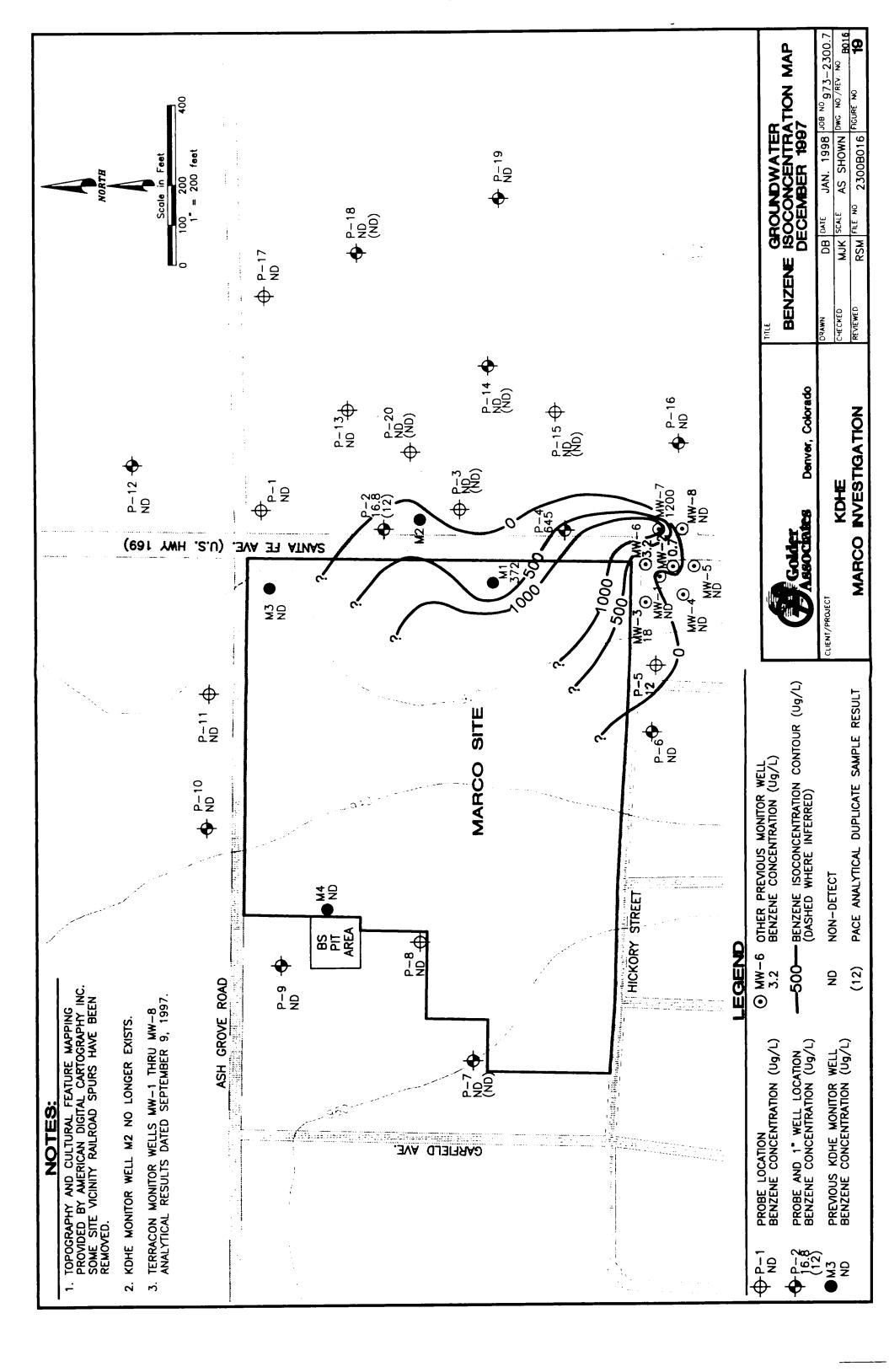


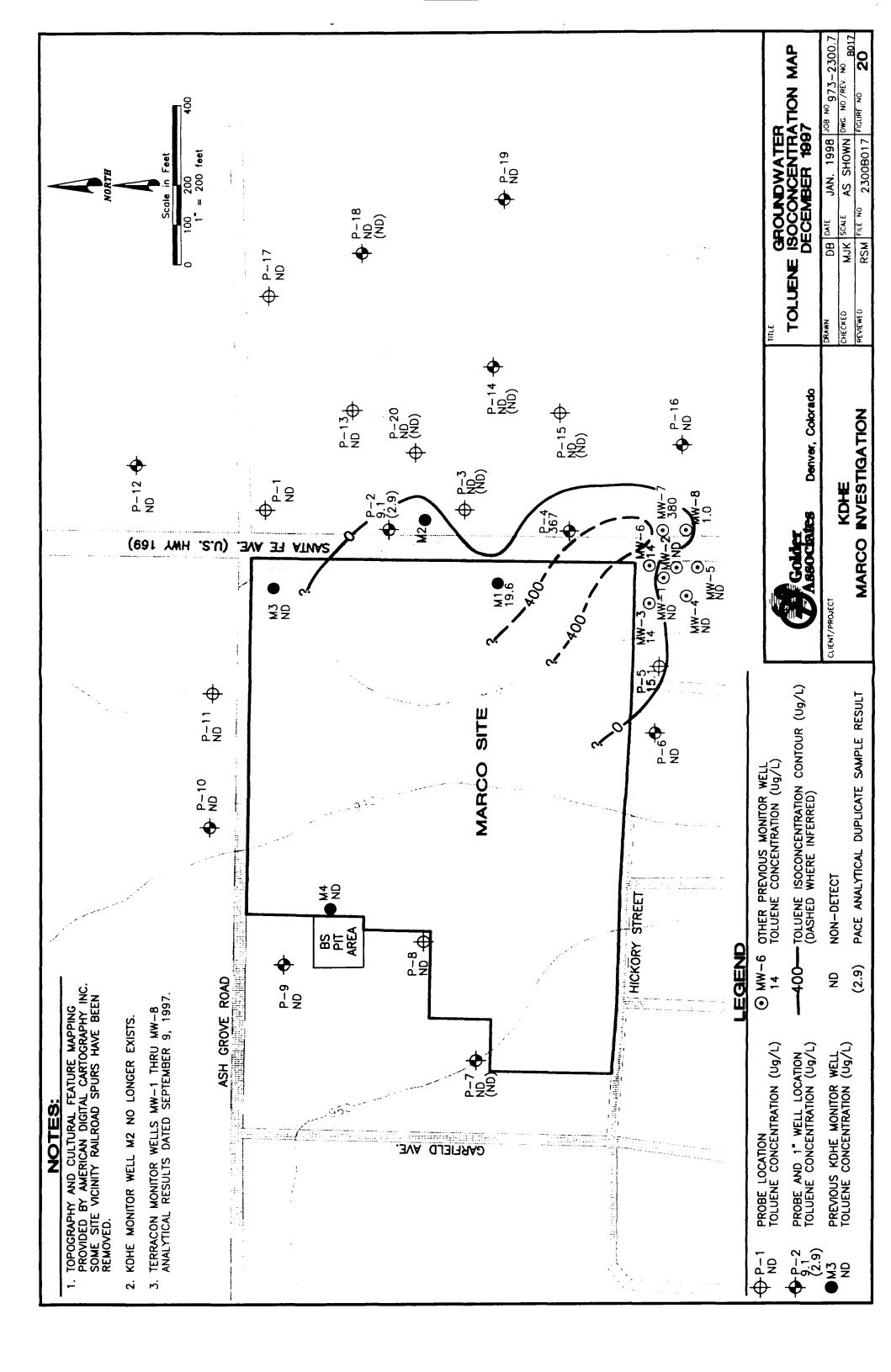


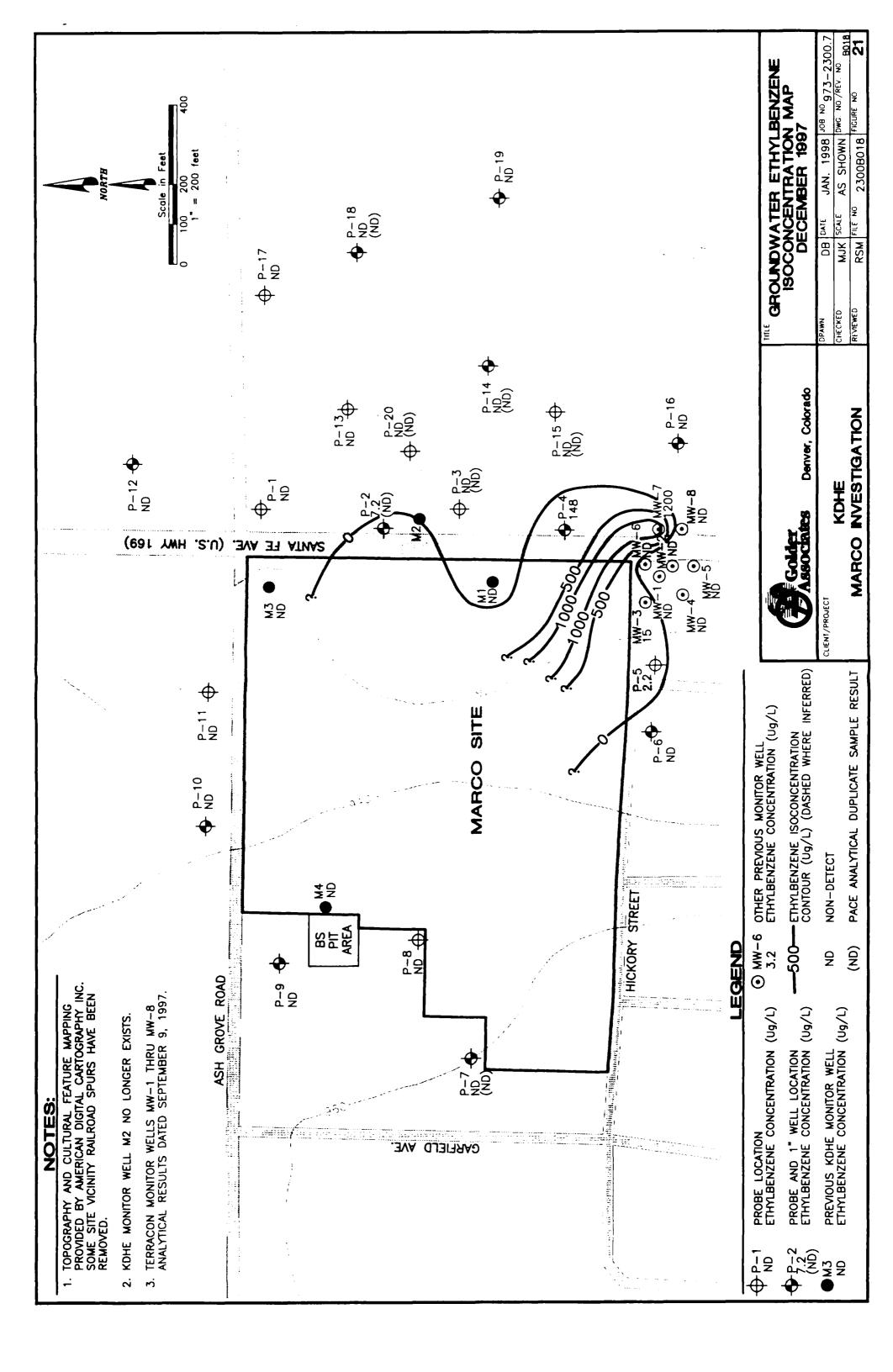
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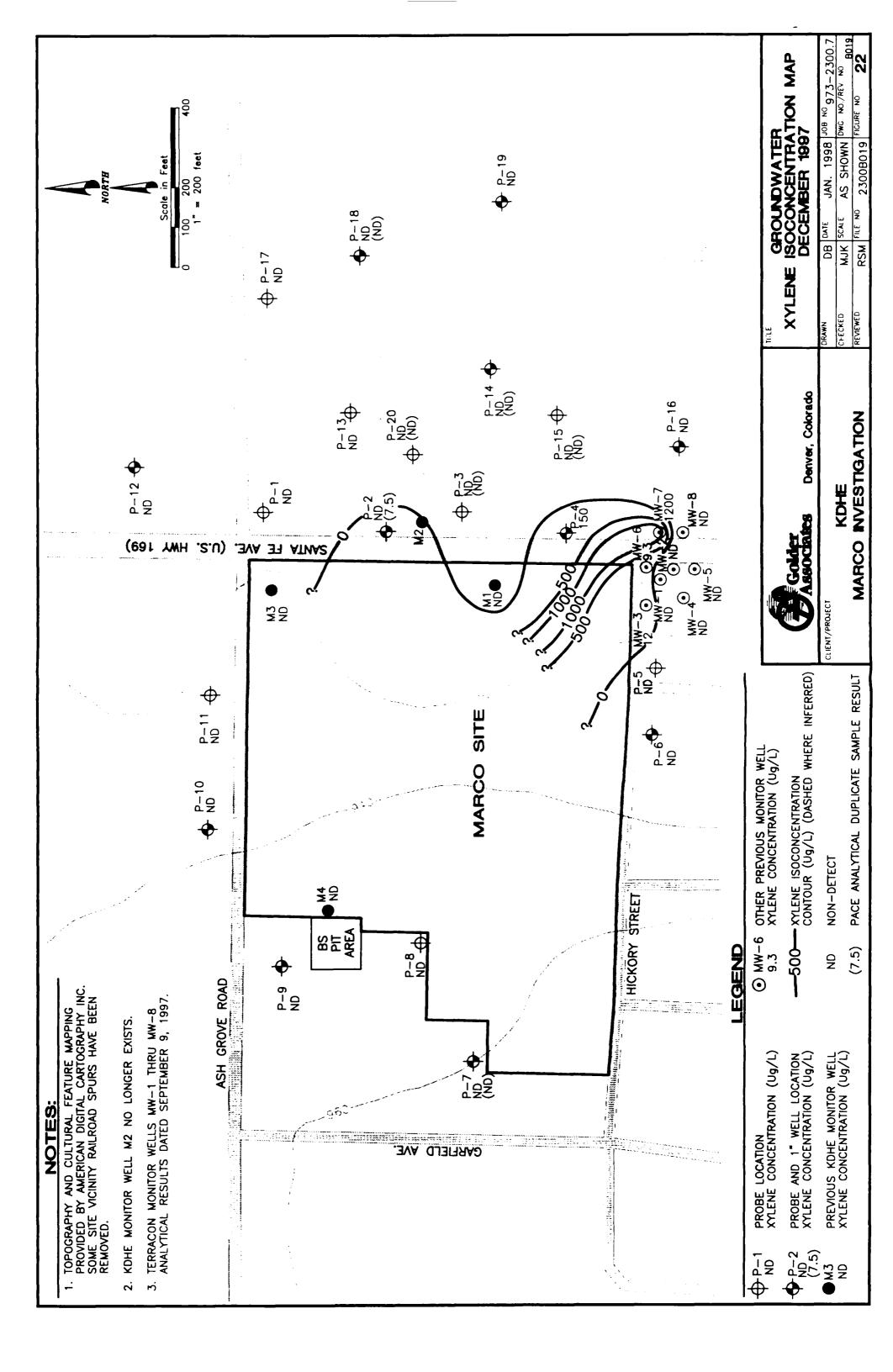
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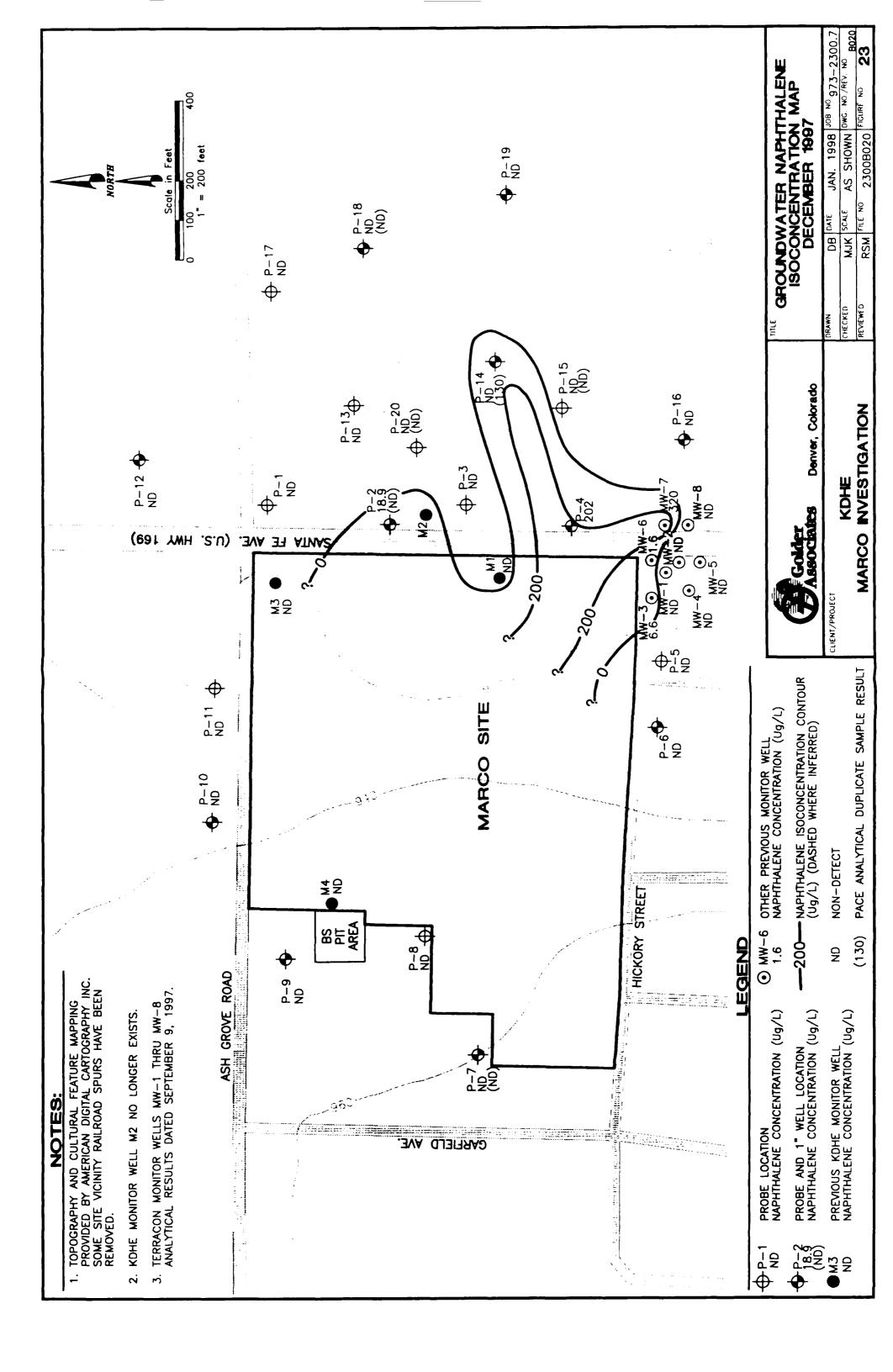




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APPENDIX A EXCERPTS FROM 1987 KDHE REPORT

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TABLE 3-4 MID AMERICAN REFINERY

WELL INFORMATION

	Static				Top of	
	Water	Top of	Total	Screen	Casing	Ground
Date	Level	Casing	Depth	Interval	Elevatio	n Elevation
		1.71′	25.0′	15'-25'	917.155′	
11/05/85	3.54'	1.92'	25.0'	15'-25'	915.29'	913.27'
	1					
11/05/86	3.83'	2.48'	27.5′	17.5'-	917.11'	914.35'
01/29/87	3.79'			27.5'	·	<u> </u>
11/05/85	5.00'	0.75'	16'	11'-15'	941.385	940.415'
	, ,			[ĺ
11/07/85	3.35′	2.79'	12.67'	7.67'- 12.67'	NA	NA
11/05/85	2.63'	1.71'	22.04'	NA	NA	NA
	11/06/86 01/29/87 11/05/86 01/29/87 11/05/86 01/29/87 11/05/85 01/29/87 11/07/85	Water Level 11/06/86 4.75' 01/29/87 5.00' 11/06/86 3.54' 01/29/87 3.69' 11/06/86 3.83' 01/29/87 3.79' 11/06/85 5.00'	Nater Top of Casing 11/06/85 4.75' 1.71' 01/29/87 5.00' 11/06/85 3.54' 1.92' 01/29/87 3.69' 11/06/86 3.83' 2.48' 01/29/87 3.79' 11/06/85 5.00' 0.75' 01/29/87 5.71' 11/07/85 3.35' 2.79'	Nater Top of Casing Total Depth 11/06/85 01/29/87 4.75' 5.00' 1.71' 25.0' 11/05/85 3.54' 1.92' 25.0' 01/29/87 3.69' 2.48' 27.5' 01/29/87 3.79' 11/05/85 5.00' 0.75' 16' 01/29/87 5.71' 11/07/85 3.35' 2.79' 12.67'	Date Top of Level Total Depth Screen Interval 11/06/86 01/29/87 4.75' 5.00' 1.71' 25.0' 15'-25' 11/06/86 3.54' 1.92' 25.0' 15'-25' 01/29/87 3.69' 2.48' 27.5' 17.5'- 01/29/87 3.79' 27.5' 11'-15' 11/06/85 5.00' 01/29/87 5.71' 0.75' 16' 11'-15' 11'-15' 11/07/86 3.35' 2.79' 12.67' 7.67'-12.67'	Nate Top of Casing Total Depth Screen Interval Elevation 11/06/86 (01/29/87) 4.75' (01/29/87) 1.71' (01/29/87) 25.0' (01/25') 917.155' 11/06/86 (01/29/87) 3.54' (01/29/87) 1.92' (01/29/87) 25.0' (01/29/87) 15'-25' (01/29/87) 915.29' (01/29/87) 11/06/85 (01/29/87) 3.79' (01/29/87) 27.5' (01/29/87) 11'-15' (01/29/87) 941.385' (01/29/87) 11/07/85 (01/29/87) 3.35' (01/29/87) 12.67' (01/2.67') NA

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KEY TO CHEMICAL ANALYSIS SUMMARY

UNITS:

Ug/l (ppb) ~ Parts per billion
Mg/kg(ppm) ~ Milligrams per Kilogram
Mg/l (ppm) ~ Parts per million

MEDIUM:

GW - Groundwater Sample SW - Surface Water Sample SOIL - Soil Sample SED - Sediment Sample SLDG - Sludge Sample

TYPE:

KNL - Kansas Notification Level

KAL - Kansas Action Level

CDC - Centers for Disease Control

OTHERS:

ND - Not Detected

NA - Not Analyzed

D - Detected

* - Many Petroleum Type Hydrocarbons Present

- Trace Levels of Petroleum Type Hydrocarbons
Present

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		_

SITE MARE: HID MRRICA PREDIGRY SITE LACATION: Chamble, RS SEL7-275-184

Micrograms/Liter UG/L (ppb)

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				Summar	Summary of VOC Analysis		•											MG/KG		
DATE			98/90/11 -	1 18/62/101			1 98/90/11	1/29/81	11/06/86	111/06/86 1/19/81 11/06/86	38/90/11	11/06/86	11/06/86	11/06/84. 1	11/06/16	11/06/16	11/06/16	11/08/86	39/22/86	91/90/11
MDIA			3	8	8	3	3	3	3	ક	5	3	a	٦	a	a	a	nos	112	300
SAMELE 10			2	2	5	5	5	5	ž	ASH GROVE	I.OUE	53	MASA	REST	C SSE	Z S S S	100	25.	2	38
NICANE ORDAICS	8	3	2	b	3	2	2	2	2	2	-	9	2	2	R	9	#	5	5	2
OFFIRETHWE PRETENTE VIDE OFFICE OLICETHWE	0.019	0.19			· 	j														
1. PECHARETHIAE THAS ACR CES 1. PECHARETHIAE TRACELEMENTANE THE TRACELEMENTANE THE TRACELEMENTANE TRACELEMENTANE TRACELEMENTANE TRACELEMENTANE TRACELEMENTANE	5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	0.5 0.8		2																
1.1.1-TICHERETHAR TITACHERETHARE THE DOLLHETHARE (THU 1.2-DIOGLERETHARE THANS 1.3-DIOGLERETHARE	0.5 0.5 0.5 0.6	\$6.0 5.0 6.0 6.0 7.0																		
TRICHERMINE NACINE DINELACREMENTANE (TIB) CIS 1,3-DIOGENETANE 1,1,2-TRICHERMEN	0.5	5.0 100.0 11.0 6.1	7.0	520.0							6.									
NEW TURK THE TAME 1.1.2.2-THE WAS TRUME THE MOST OF THE SET OF THE	2.000	2000.0	2	i i																
FINIANZAJIE NETA-ZYLZNE ORDIO LAUR FARA-XYLZNE 1, JDIORLERENJENZANE 1, Z. DIORLERENJENZE 1, S. DIORLERENJENZE 1,	6.3.3.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.	640.0 640.0 620.0 750.00	13.0	% 7.0 % 7.0																
TUTAL VCS	10.80	100.00	215.90	5.3.2							6.									

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		_

SITE NWE: NID AWRICA RETINENT SITE LACATION: CIWANTE, KS

MICROGRAMS/LITTER (UG/L) (FTB)

Summary of Acid Extractable Analysis

1 9/25/86 111/06/86 SIBC 3 2 11 83 Ź Ħ MG/KG 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 200 ISS. 9 MSDI 8 9 MASVJ ਨ 2 MSN2 돐 Ź MASVI র 2 LARKIN 3 욧 IASH GROVE! F.CRUDE 3 ≨ ₹ 9 3 ¥ 乭 5 3 ₽ 3.0 Δ 겊 ₹ 10.2 3 Z 110.0 13.4 220.0 290.0 300.0 400.0 17.0 290.0 ₹ 1.7 300.0 11.0 1.34 22.0 .02 30.00 50.00 70.00 29.0 Š PRIORITY FOLLITANT ACID EXPRACTABLES! SWELL ID AT OFF 2,4-DINITROPIGNAL 4,6-DINITRO-O-CRESAL PENTACIALROPIGNAL 2,4,6-TRICHLIRGTERAL 4-CHLIRO-H-CHEXXI, 2, 4-DIDETHILMENCE, 2, 4-DIDECRAMENT ORTHO-CIECRCHENCE. 2-HITRUTENCE 4-HITRUFIGMA MEDICAL

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SITE NAME: MID AMERICA RUFINGRY

SITE LOCATION: COMUTE, KS

MICROPANS/LITTRY (UC/L) (179)

111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 SEC 3 ş 3011 Ä క 2017 S ş MG/KG RSDI B ş MSA) ş 2 POSV2 ð ઢ MOSAI ₫ ह 3 ₹ 오 Summary of Base Neutral Analysis F. CRUDE ₹ ٤ ASII GROVE! 175.0 ۵ ₹ 乭 ₽ 135.0 0 3 Z 9 Ę 12.9 96.3 ۵ ₽ ટ 5 29.5 9 ₹ 겆 B 夏 15.5 28.1 욧 3 귚 5 .029 20. 20. 820. 620. 620. 670. 820. 920. 620. 14).0 7 ₹ 350000 9 0.01 <u>(28</u> .007 16200. .00 .00 .00 .00291 1828 .00291 1 0.77 16200. .00. 1.6200. 1.6200. <u>82</u>00. | Ξ. 5.0 .02 0.02 ğ **:** CIRYSTAE L/OR RUNGO (A) ANTIBACTOR BYDOC(B) 4/OR (K) MULLAWTIDYE PRIMITIBILITY E/CR WITHRACTIVE SAPIL 10 BIS (2-CIBLORCETHYCAY) NETHONE. H-COLLECTION INDIN ETHEN BIS(2-ETIMARAYI,) PITIOLATE BIS (2-CHLOROI SOFROTYL) ETHER 1- NRCHLYTOWN, FIRM KINIX PRIORITY POLLUTANT BASE NEUTRAL EXTRACTABLES NIS (2-COLLORUCTIONL) ETHEN IMMAD(1, 2, 3-C, D) PYRING DIMATO(A, H) ANTIRACIAE MIE 1,2,4-TRICHLOROBORDE BUTTL RINCILL PHINULATE DI-H-CCTYL PIMILIATE I-N-IUTH, INTIMATE NYGOIG, II, I) FERTLINE 2-KETHYL-NATHWAINE **EXACTLC/RODUTADIENC** 2-CIECRUMITIMEDE 2, 4-DINITROTUMBLE 2,6-DINITROTULUDE DIMETRIAL PRIMARE DIETING PINNATE **EXACIDITATION CONTROL** DANCECROETIME KINWIMINE NESTED (A) PYRENE **NOWNITHONE** FLICKAMTIENE MYTHALINE PLUCRIME

175.0

135.0

109.2

1 29.5

\$.€

10.0

0.1

TUTAL PASE NEUTRALS (TIB)

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SITE NAME: KID AWAICA RAFINEAY SITE LOCATION: CHANTE, KS

MICRORANS/LITTR (UG/L.) (FTB)

Summary of Heavy Metal Analysis

111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/86 | 111/06/ 33 SLEC Ź 3011 MG/KG ₹ 덛 3 3 Ş MASO! 8 ≨ CASSA) 2 Þ PASAZ 2 Ź 280.0 160.0 2.0 270.0 7. 5 € € 0.0 6 € € 0. 99899 ភ **5 5 5** 80.0 10.0 2.0 180.0 9 9 2 9 9 9 9 2 9 9 원 원 <u>왕</u> 호 LARGIN **£ £ £** ₹ F. CRUDE 2 3 ASII CROVE 3 Ź 4090.0 改 150.0 1.0 5 5 8 5 5 6 6 8 5 5 - **5** 6 **€ ₹ \$ \$ \$** 3 X 1210.0 760.0 3.0 200.0 **£** £ £ 3 ₹ 30.0 1.0 **4**270.0 2390.0 2.0 320.0 **5 5 5** 3 뎦 7590.0 2430.0 5.0 470.0 5 5 5 2 0 0 2 2 0 1.0 ≨ ≩ 5 로 **£ £ £** KAL (WATER) 300.0 50.0 1000.0 5.0 50.0 500.0 5000.0 5000.0 50.0 1000.0 50.0 2.0 1000.0 143.0 13.0 1) ZZLORS 1) ZZLORS 1) ZZLORS 1) SZLORS (30 E) 11111 111 SWELL ID ATO IA PATE CORCHIUM(+3) HANCANTSE ARSTAIC BARIUM BERNLLIUM SELENTUM SILVER ZINC ALMINUM WITH MY TIMILLIUM CULTER LEND HERCURY CURIUM MICON. METALS

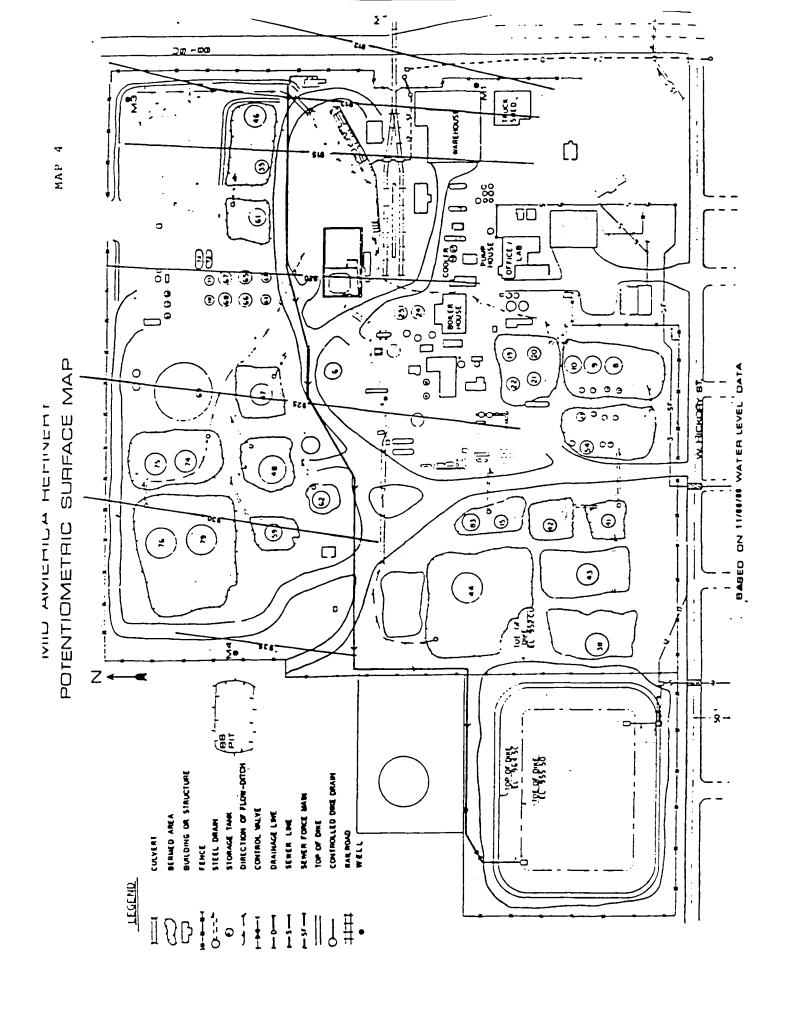
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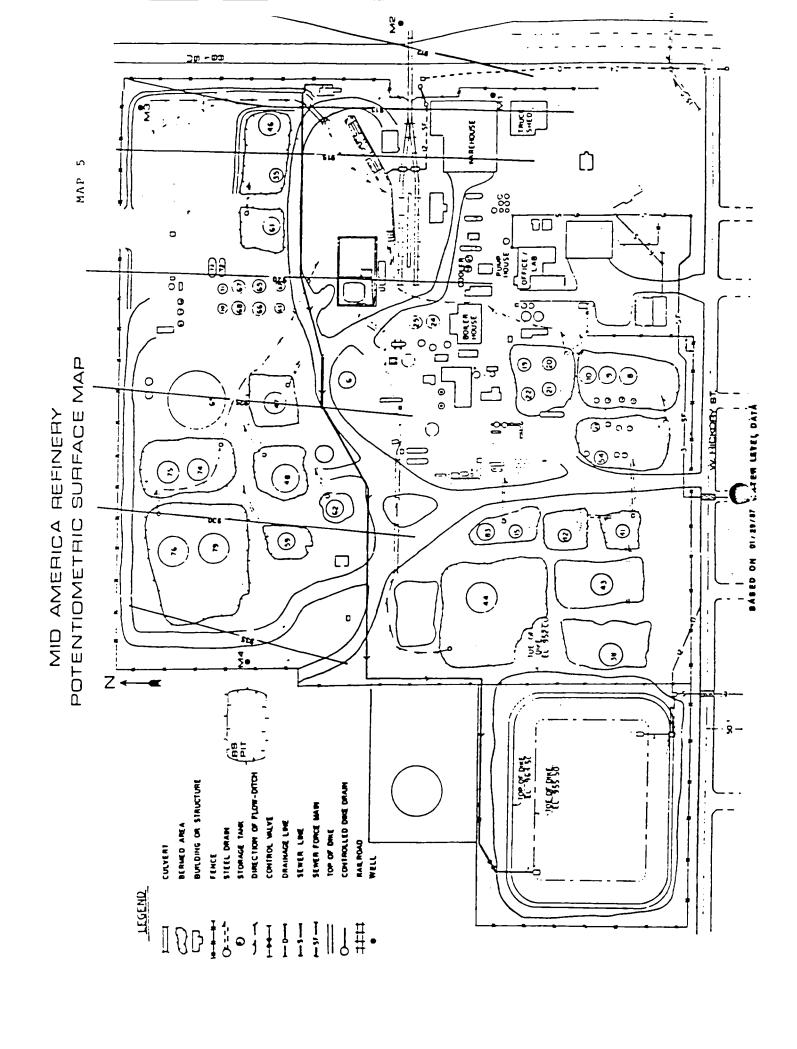
SITE IWE: HID MERICA RETIVERY SITE LOCATION: CHWNIE, KS

HILLIGAMS/LITER (NC/L) (FITH)

111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 111/06/86 109/25/86 111/06/86 SLLC ₹ S ⊴ 3011 2 2 301 3 Þ MG/KG MASDI SB క్ష HASA) 5 Š PASA2 2 2 1 292.0 1 117.0 1 87.0 1 .49 HASVI 367.0 120.0 16.5 96.9 **5 5 5 5 5 £** £ £ £ £ **\$\$\$\$**\$ ઢ ≨ ≴ 290.0 4.3 46.0 1.10 ≥ ¥ 50° ¥ ₹ LARKEN 5.**♣** 8.0 357.0 134.0 **5 5 5 5 5 5 5 5 5** ≨ ≲ ≶ ≨ ≸ ≨ ≲ ઢ ASH GROVE F. CRUDE 270.0 129.0 263.0 .04 426.0 131.0 24.1 118.8 3 ₹ **£ £ £ £ £ 2222** \$ \$ \$ \$ \$ ≨ ≲ Inorganic Analysis 5 ≨ 158.0 482.0 517.0 .46 ¥ ¥ ₹ ₹ ¥ 58.0 ¥ ¥ 5 823.0 225.0 63.6 283.0 1.6 **5 5 5 5 5** ≨≨≨≴ ≦ ≥ 3 ž 266.0 23.0 19.0 .02 ≥ ≥ ≥ ≥ ≥ ⊙. 204.0 56.5 15.4 60.0 Summary of 2222 **\$ \$ \$ \$ \$ \$ \$ \$ \$ \$** ≨ ≥ 3 3 된 5 **6** 5 2 **3** 1 467.0 1 57.0 1 114.0 512.0 154.0 31.2 92.9 9 2 2 2 2 2 2222 ≥ ≥ ≥ ≥ ≥ ≨ ≳ 3 丑 .02 517.0 80.0 11/06/86 530.0 148.0 39.1 69.8 ኞ 517.0 ጀ 5 2222 2222 2222 ્ર ≨ 3 덮 (5.5) 9.51 250.0 250.0 10.0 1000.0 18111 11181 ₹ 1111 11 SANTLE ID MEDIA WIE T. DISSOLVED SOLLDS TUTAL PROGRESSIVE (P) TUTAL IMAD. (CACU) HARD AKALMITY CARICINIE IMPIDESS IUTAL AIX. (CACU)) MENTO CENTRE Inorganies (UNI) YTIGIJANI T. SUIS. SOLLIDS SPECIFIC OUR. SILICA (SIC2) FLASH FURT SULLATE HITRATE (H) VELETIA (N) ULLCRUASE HACIES IUM Bautum NIASSIUM CHLARIDE HURRIDE CYMILE CALCIUM 3017.105 111111L

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GEOLOGIC CHOSS SECTION LOCATIONS

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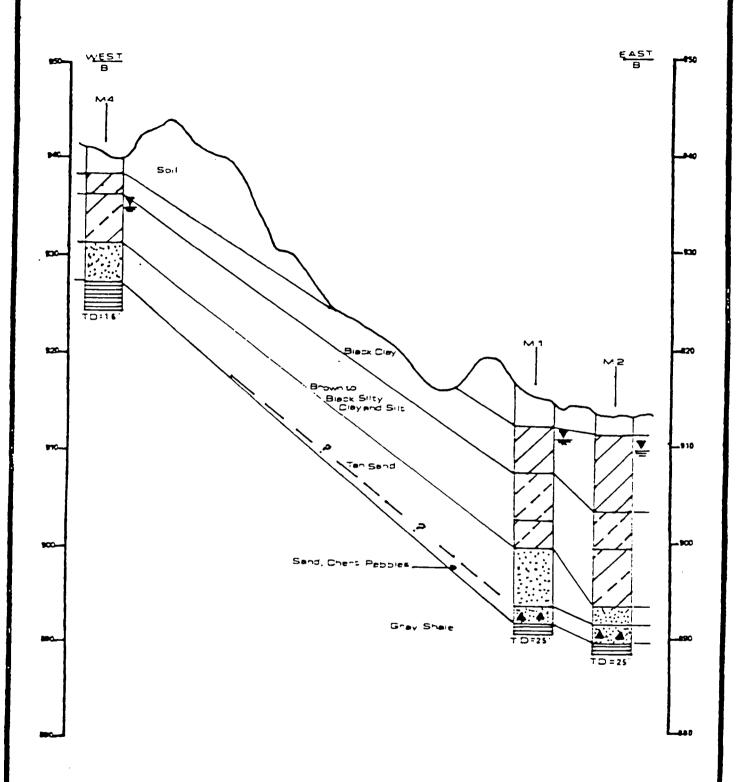
GEOLOGIC CROSS SECTION A - A SOUTH! H<u>TRQ</u>M -130 \$20 Soil -910 Black Clay Brown to Black Silty Clay and Silt Ten Sand Sand, Chart Pabbles TD:25' Gray Share TD:25 TD=27.5 HORIZONTAL SCALE 174 125" VERTICAL SCALE 1710

PIEZOMETRIC ELEVATIONS 01-29-87

KDHE

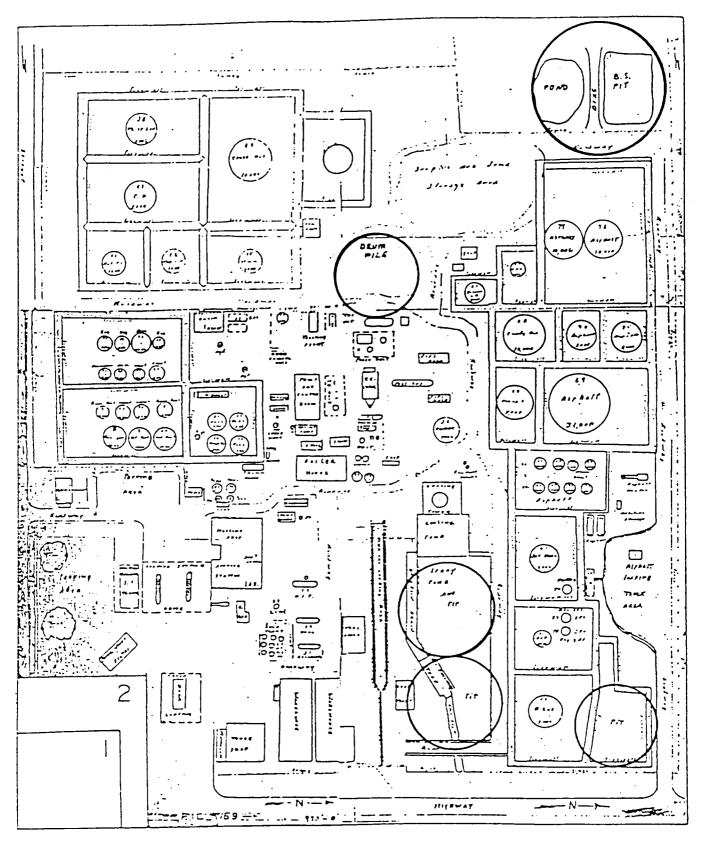
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HORIZONTAL SCALE 1"1225" "
VERTICAL SCALE 1"-10" "
PIEZOMETRIC ELEVATIONS 01-28-87

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MID - AMERICAN REFINERY PLANT SKETCH 13th Feb. 1986

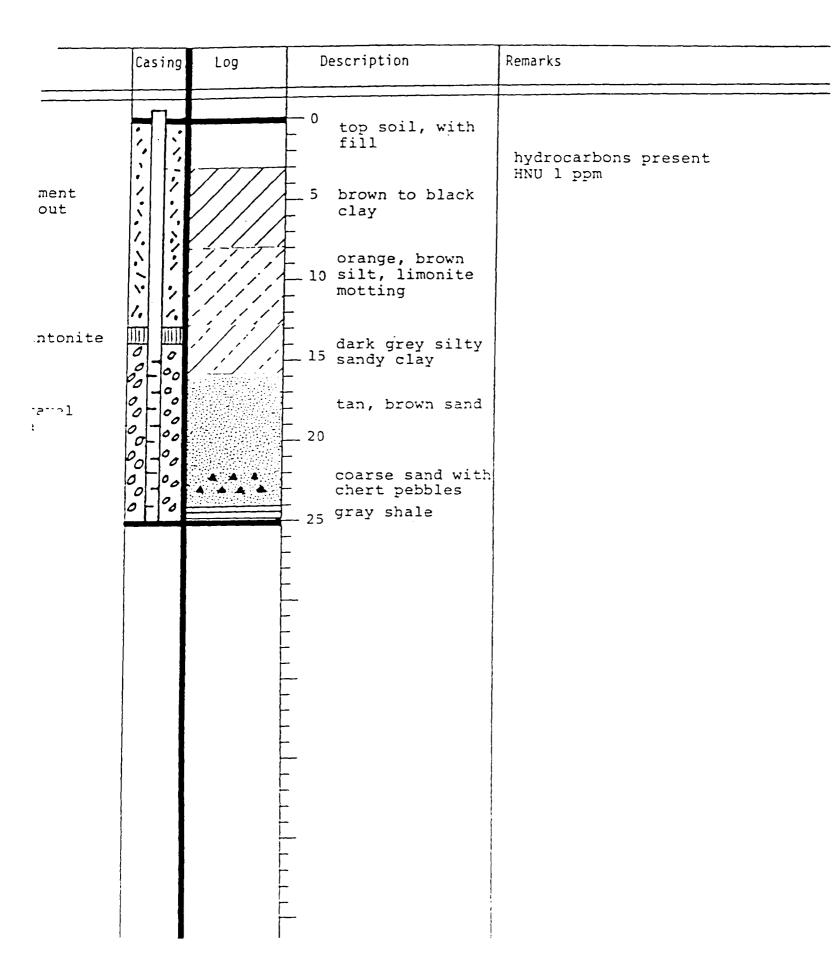
SUPPORT ZONG - Area where command post will be located.
CONTENSIONATION REDUCTION ZONE - Area of decontamination.
EXELUSION ZOME - Area(s) of alledged contamination.

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.OUECT SITE Mid America Refinery
.EGAL LOCATION SE NE SE 17-27S-R18E
GLL ALIAS M1 DATE 09/25/86 SELLER KDHE - Jack Slade LOGGED BY Bill Thornton
FILLING METHOD Solid stem auger HOLE SIZE 4 inch CASING DETAILS 2 inch threaded flush joint PVC casing from 0' - 15'
SECUTING DETAILS cement grout 0-13 feet bentonite 13-14
JELL EVACUATION DETAILS pumped out 5 casing volumes before sample was taken
5.L.ELEV. 915.29 STATIC WATER LEVEL 5.0' on 1/29/87
SFEEMED INTERVALS 15' - 25'

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City, State,	ZIP Code	:		<u></u>				ation Number.	,
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* w	1		ELL WATER TO B	E ÜSED AS:	5 Public wa	er supply	8 Air conditio	ning 11	Injection well
7 1	1.	! X	1 Domestic			ater supply			Other (Specify below)
	- sw	35	2 Imigation				10 Observation		
	- i - j	i] w	as a chemical/bacte			epartment?	Yes. 💢No.	# yes.	mordayfyr sample was si
<u> </u>	5	mi	tted	10/2/86	<u> </u>	W	ater Well Disinf	ected? Yes	(No)
5 TYPE OF	F BLANK C	ASING USED:	5 V	Vrought iron	8 Cons	rete tile	CASING	JOINTS: Glues	d Clamped
1 Stee	el	3 RMP (SR)	6 A	sbestos-Cement	9 Other	(specify beto	ow)	Weld	ed
2 PVC		4 ABS		īberglass					ded)
									in. 10 1
Casing heigh	ht above lar	nd surface/	7./in., :	weight		lbs	Jft, Wall thickne	ess or gauge No)
TYPE OF S	CREEN OR	PERFORATION M	MATERIAL		73		10	Asbestos-ceme	nt
1 Stee	el .	3 Stainless st	eel 5 F	iberglass		AP (SR)	11	Other (specify)	• • • • • • • • • • • • • • • • • • • •
25:25		4 Galvanized		ionorete tile	9 A	BS		None used (op-	en hole)
SCREEN	ಎ ೯೯೩ ೬೦ನಿ	SENINGS NCITA	ARE:		d wrapped		8 Saw cut		11 None (open hole)
	متلع عنحررون		tot	6 Wire v	игарред		9 Drilled hol		
	vered shutte		ounched / <	_ 7 Torch			10 Other (spi	ecity)	· · · · · · · · · · · · · · · · · · ·
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6.5		K INTERVALS:)
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,	MATERIAL:	1 Neat cem	ent (2 de	ment grout	(2) Sent	nite 4	Other		
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ROJECT SITE Mid America Refinery
EGAL LOCATION NW NW SW 16-27S-R18E
ELL ALIAS M2 DATE 09/25/86 EILLER KDHE - Jack Slade LOGGED RY Rick Bean
RILLING METHOD solid stem auger HOLE SIZE 4 inch ASIMG DETAILS 2 inch threaded flush joint PVC casing from 0' - 15'
FOLITING DETAILS Cement grout 0-13 feet bentonite 13-14
ELL EVACUATION DETAILS pumped out 5 casing volumes before sample was taken
.L.ELEV. 913.27 STATIC WATER LEVEL 3.69' on 1/29/87
DREENED INTERVALS 15'-25'

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MZ LITHOLOGY

·	Casing	Log	Description	Remarks
cement	***********		0 top soil, with fill brown to black clay	нии - 0 ррт
bentonite avel	1111100000000		brown to black silty clay 15 brown sand and clay	
	00-00		reddish brown sand chert pebbles and sand dark grey shale	

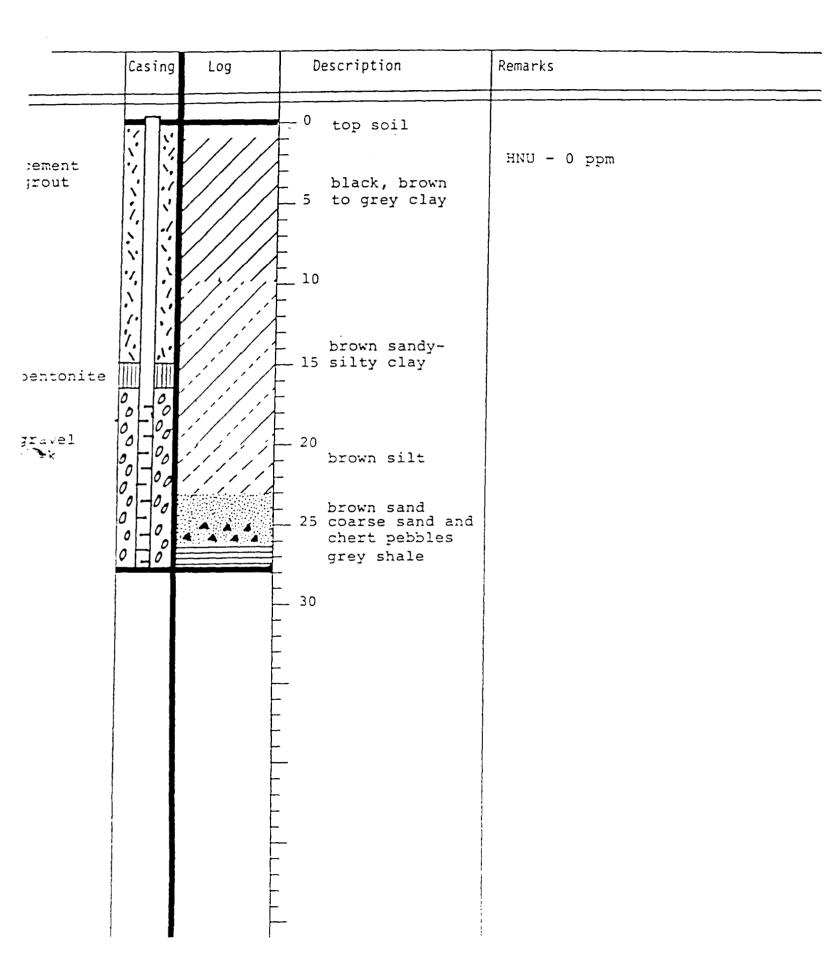
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Distance and direction from nearest town or city stre	et address of well il located			
	Sinta Fe	<+.		
3 WATER WELL OWNER: MARCO UA++	•) Doord of (lava li va D. a sa at Mus. B
RRW, St. Address, Box # : P.O. Box 31		(N/2)		Agriculture, Division of Water Resourc
City. State. ZIP Code : Changle 163	2 46720	-c\	Application	
BI LOCATE WELL'S LOCATION WITH 4 DEPTH C	F COMPLETED WELL.	→	EVATION: 706	913.L95
				h 323'h
WELL'S STA	ITIC WATER LEVEL . Fe. 7	スチ、、ft. below land	surface measured or	n morday yr 1/16/86
	ump test data: Well water	was	t. after	. hours pumping gp
NW NE Est. Yield	gpm: Well water t	ا ر . سبر بر was	t. after	hours pumping gp
Bore Hole Di	iameter A in. to	25		in. to
	1	Public water supply	8 Air conditioning	11 Injection well
1 Dome:			9_Dewatering	12 Other (Specify below)
SW SE 2 Irrigati			y 10 observation we	
				; If yes, mo'day' <u>vr sample was si</u>
	10/2/86		Water Well Disinfecte	
TYPE OF BLANK CASING USED:	5 Wrought iron	8 Concrete tile		INTS: Glued Clamped
1 Steel 3 RMP (SR)	6 Asbestos-Cement	9 Other (specify b	elow)	Welder
, (2)-vc 4 ABS	, 7 Fiberglass		· · · · · · · · · · · · · · · · · · ·	Threaded /
Blank casing diameter				
Casing height above land surface	in., weight		bs./ft. Wall thickness i	or gauge No
TYPE OF SCREEN OR PERFORATION MATERIAL:		7 byc	10 Asb	estos-cement
1 Steel 3 Stainless steel	5 Fiberglass	B RMP (SR)	11 Oth	er (specify)
2 Brass 4 Galvanized steel	6 Concrete tile	9 ABS	12 Nor	ne used (open hole)
SCRESNOR PERFORATION OPENINGS ARE:	5 Gauzed	wrapped	8 Saw cut	11 None (open hole)
1 Continuous slot 3 Mill slot	6 Wire wa	apped	9 Drilled holes	
2 Louvered shutter 4 Key punched	7 Torch cu	л.	10 Other (specify	·)
SCREEN-PERFORATED INTERVALS: From	15 11 10 2	っ <i>一</i> /	• • •	t. 10
From	, , ,			ft 10
GRAVEL PACK INTERVALS: From	1.4 tt. to	<i>5</i>	From	ft. 101
GRAVEL PACK INTERVALS: From /	ft. to	ろ	From	ft. 10
GRAVEL PACK INTERVALS: From	ft. to	5	From	1
GRAVEL PACK INTERVALS: From	tt. to . 2 tt. to . 2 (2 Cement Fourt . 13)	3 Bentonite ft. 14	From	ft. 10
GRAVEL PACK INTERVALS: From. From GROUT MATER: 1 Neat cement Int. to	tt. to . 2 tt. to . 2 tt. to . 2 cement fout tt. From . 13'	3 Sentonite 10 Lin 11 Lin 12 Lin 13 Sentonite 10 Lin 14 Lin 10 Lin 10 Lin 10 Lin 10 Lin 10 Lin 10 Lin	From 4 Other ft., From vestock pens	ft. to
GRAVEL PACK INTERVALS: From From GROUT MATERIA 1 Neat cement ut Intervals: From	tt. to 2 tt. to 2 Cemera From 13'	3 Sentonite 10 Li 11 Ft.	From 4 Other ft., From restock pens sel storage	ft. to
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OJECT SITE Mid America Refinery
LEGAL LOCATION NE NE SE 17-275-18E
DETILER KDHE - Jack Slade LOGGED BY Rick Bean
DETILLING METHOD solid stem auger HOLE SIZE 4 inch CASING DETAILS 2 inch threaded flush joint PVC casing from 0' - 17.4'
GROUTING DETAILS_cement grout 0-10 feet bentonite 15'-16.4'
WELL EVACUATION DETAILS pumped out 5 casing volumes before sample was take
5.L.ELEV. 914.35 STATIC WATER LEVEL 3.79' on 1/29/87
BOREEMED INTERVALS 17.4' - 27.4'

M3 LITHOLOGY



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Distance and pirection	3/10	Fraction Va	UE VSE	Na.	17	T	$\frac{\sqrt{2}}{2}$ Sumber	1 - 1 -);_~:e
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WATER WELL O		C C	BJCAN_J	J.E. LIL	7-				
RR#, St. Address, B	KDD	£				Воа	rd of Agricult	ture, Division of Wa	iter Resou
City, State, ZIP Code						А рр	lication Num!	ber	
LOCATE WELL'S	LOCATION WITH 4		LETED WELL						
AN "X" IN SECTIO	N 100	epth(s) Groundwate							, . .
1 !		ELL'S STATIC WA							86
	NE		t data: Well water						
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	'^ '"	1 Domestic				9 Dewateri	•	12 Other (Specifi	/ helow)
SW	SE	2 Irrigation				10 Observat			
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<u> </u>		πed		36		Vater Well Dis			₹.
TYPE OF BLANK	CASING USED:	5 V	Vrought Iron	8 Concr	ete tile	CASIN	IG JOINTS:	Glued Clan	nped
1 Steel	3 RMP (SR)	6 A	sbestos-Cement	9 Other	(specify be	iow)	1	Welded	
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asing height above I			weight		~			-	
	R PERFORATION N	_		76			0 Asbestos-		
1 Steel	3 Stainless ste		iberglass	9 AP	AP (SR)			cify)	• • • • • • • •
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		From	tt. to		tt., Fi	mor		ft. to	
		- 1/-	И t t. ю	7 1 11					
GRAVEL PA	CK INTERVALS:	From	n. w	4107.	. tt., Fi	om		ft. to	
		From	ft. 10	4107.	t., F	om		ft. to	
GROUT MATERIAL	.: 1/Neat cem	ent (ch (2)e	ft. to	3 Bento	tt., Fi	om 4 Other	· · · · · · · · · · · · · · · · · · ·	ft. to	, ,
GROUT MATERIAL out Intervals: Fro	.: 1/Neat cemi	ent 29e	ft. 10	<u> </u>	tt., Fi	om 4 Other 1. ft., Fro		ft. to	
GROUT MATERIAL out Intervals: Fro hat is the nearest so	.: 1 Neat cerm m	ent (2 9e to . / C/2) etamination:	ment grout ft., From/.5.	<u> </u>	tt. Fi	om 4 Other 5. Z. ft., From the stock pens		ft. to	ar wati
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GROUT MATERIAL Jut Intervals: Fro hat is the nearest so 1 Septic tank 2 Sewer lines 3 Waterlight sew rection from well? FROM TO // / S // / / / / / / / // / / / / /	Jest community of the state of	From ent to /// 29e to /// 29e to /// 29e to /// 29e to // 29e to	ft. to ment grout ft., From ./5. 7 Pit privy 8 Sewage lagoo 9 Feedyard brown Cky Silt Clayey Selt Storm A pebbles	FROM (1) constru	10. / 6.4 10 Live 11 Fue 12 Fer 13 Inss How m TO	om 4 Other 5 ft., From the stock pension of the storage extrained storage and feet? 20 ft., From the storage extrained storage and feet?	0 / / 300 LITHO	ft. to ft. to 4 Abandoned wate 5 Oil well/Gas well 6 Other (specify b 56 PCC/47 LOGIC LOG	er well ii velow) / / / / ion and w
GROUT MATERIAL Jut Intervals: Fro hat is the nearest so 1 Septic tank 2 Sewer lines 3 Watertight sew frection from well? FROM TO July July July July July July July Jul	Jest community of the state of the state of possible con state of the	From ent to / / / 29e to / / / 29e to / / / / / / / / / / / / / / / / / / /	ft. to ment grout ft., From . /5. 7 Pit privy 8 Sewage lagoo 9 Feedyard Drown Clay 5 Jf Clayey Seld Store A Pebbles	FROM (1) constru	tt. Finde 10. /6. 10 Live 11 Fue 12 Fer 13 Inst How m TO	om 4 Other 5. ft., From the stock pension of the storage octoide storage any feet? 2 constructed, or cord is true to to the storage octoide.	(3) plugged the best of my	ft. to ft. to 4 Abandoned water 5 Oil well:Gas well 6 Other (specify b Set posicial) LOGIC LOG	er well II Pelow) / / / / In and w
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ROJECT SITE Mid America Refinery	
EGAL LOCATION NW NE SE 17-275-18E	
ELL ALIAS M4 -DATE 09/25/86 EILLER KDHE - Jack Slade LOGSED BY Rick Bean	
RILLING METHOD solid stem auger HOLE SIZE 4 inch CASING DETAILS 2 inch threaded flush joint PVC casing from 0' to 11'	
SECUTING DETAILS cement grout from 0' - 9' bentonite 9' - 10'	
JELL EVACUATION DETAILS pumped out 5 casing volumes before sample was to	iaker
3.L.ELEV. 940.415' STATIC WATER LEVEL 5.71' on 1/29/87	
COREENED INTERVALS 10'-16'	

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M € LITHOLOGY

<u></u>	Casi	ing	Log	Description	Remarks
gravel	ハハ・ハ・ハ・ハ・	ng 1.1.1.1.1.1.1 0000000	Log	top soil dark black clay brown sandy clay tan sand grey shale	HNU - 0 ppm
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				-	

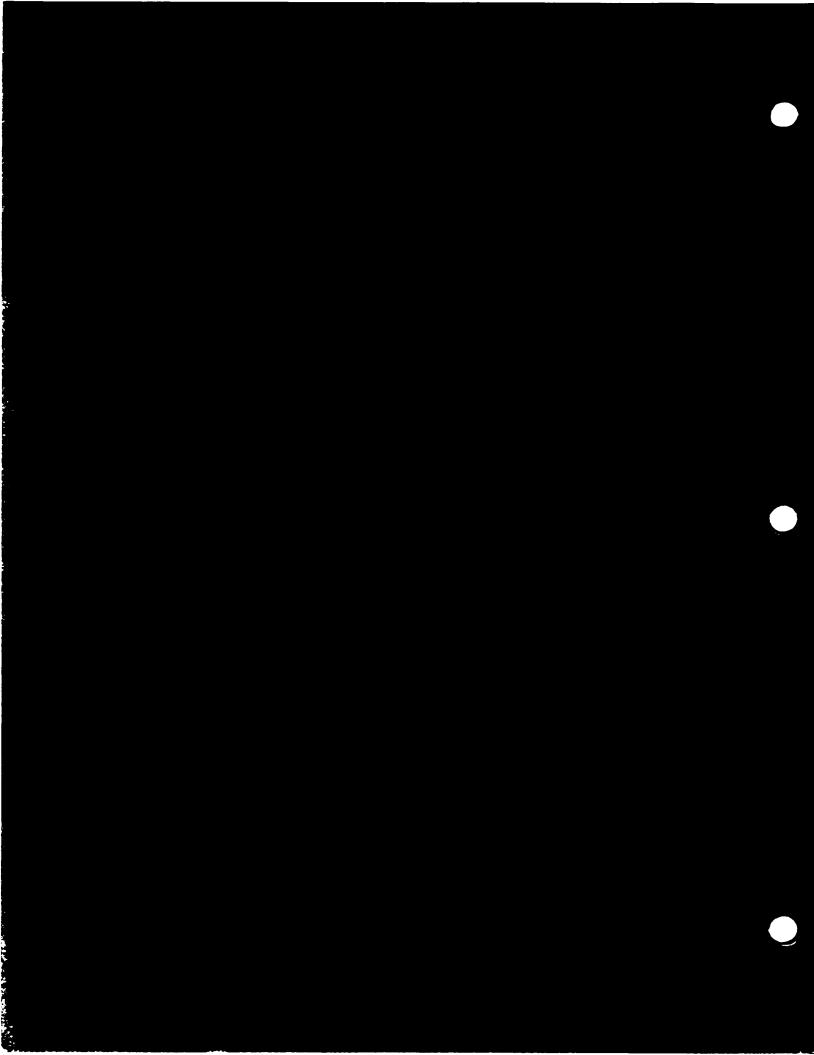
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11/1/2 /1/20	ion from nearest town of	CIDY Street addition	ss of well if located	1 within city?		1 7	<u> </u>	ニュノニノ、しゅ
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	Box 1 : P. 0 - B		66720	,	(///	, ,	ation Number:	ASION OF WATER HESOURC
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* w	l Box	re Hole Diameter.	•					o
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- 1		1 Domestic				9 Dewatering		ther (Specify below)
># -	- ";	2 Imigation		_		10 Opservation		
1 i	l Wa	is a chemical bacte	riological sample s	ed ot bettimdu				nordayryr <u>sampl</u> e was su
!	5 mitt	led / (C	12/86		<u> </u>	ater Well Disinf	ected? Yes	
TYPE OF BLANK	CASING USED:	5 V	Vrought iron	8 Concre	te tile	CASING	JOINTS: Glued .	Clamped
1 <u>Stee</u> l	3 RMP (SR)	6 A	sbestos-Cement	9 Other (specify belo	ow)	Welded	~~
RES	4 ABS	, , , 7 F	iberglass					
Blank casing diamet	er in	to . // /	. ft., Dia	in. to .	<i></i>	ft., Dia	in.	to
Casino height above	land surface/	ユin.,	weight	<u></u>		Jft. Wall thickne	ss or gauge No.	
	OR PERFORATION M		•	7 PVC			Asbestos-cement	
1 Steel	3 Stainless ste		iberglass	8 RM	P (SR)	11	Other (specify)	
2 Brass	4 Galvanized s	_	Concrete tile	9 ABS	;	12	None used (open	hole)
	ORATION OPENINGS			d wrapped		8 Saw cut	• •	1 None (open hole)
1 Continuous		•	6 Wire w	тарред		9 Drilled hol		
Louvered sh			7 Torch	• •				
SCREEN-PERFORA				1/	. t. Fr		• •	
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CONTRACTOR'S	OR LANDOWNER'S	ESTEBOATION: T	his water well was	(1) construct	ed, (2) rea	onstructed, or (B) plugged under	my jutisdiction and wa
ompleted on (morda)	yyear) . 07/24	1.26						edge and belief. Kansa
Nater Well Contracto			This Water Wel				110-6-	8-6
eger the business n		7/7 <i>E</i>			by (signa		KF30-	
STRUCTIONS US	typewriter or ball point pen.	PLEASE PRESS FIR	MLY and PRINT clearly	Please fit in bi	anis, underlir	ne or circle the con	ect answers. Send to	p three copies to Kansas
	and Environment, Office of O NER and retain one for you		^{ബൈ} ഗമാശ്യ, നരുവിഷ്	on and reimiliir	iy Sestion, To	река, калѕаѕ 660	zu-7500, i elephone	919-862-9360 Sendione

APPENDIX B SUPPLEMENTAL SUPPORTING DATA

DIX B-1 **EXCERPTS FRO** RACON 1997B REPORT

January 1998 973-2300.7



November 10, 1997

Ms. Leticia Arzate Kansas Department of Health and Environment Forbes Field, Building 740 Topeka, Kansas 66620-0001

2111 Wasi Harry Street Wichita, Kansas 67213 (316) 262-0281 Fax: (316) 262-6097

John & Hanwall PE S. Randy Alewing, P.E. Douglas A. Aldrich, P.E. Konneth C. Wallace Michael J. Wilcox

RE: Monitoring Report #2, August through October, 1997

Fina #3058 1125 N. Santa Fe Chanute, Kansas

KDHE Project code U3-067-264

Project No. 52975059

COPY SENT TO EXCITAGO OFFICE

Dear Ms. Arzate:

Terracon Environmental, Inc. (Terracon) has completed groundwater sampling event #2 at the above-referenced site in general accordance with our Proposal dated July 8, 1997. Field work was conducted on September 9, 1997. The following information is submitted for your review.

- Historical Groundwater Elevations (Table 1)
- Historical Groundwater Laboratory Results (Table 2)
- Groundwater Contour Map (Figure 1)
- Total BTEX Isoconcentration Map (Figure 2)
- Field Records
- Laboratory Reports

RECEIVED

NOV 1 2 1997

1.0 RESULTS

BUREAU OF ENVIRONMENTAL REMEDIATION

As indicated in Table 1, groundwater levels declined about 0.5 foot from July 1997 to September 1997. Groundwater flow direction is generally to the east (Figure 1).

Total BTEX concentrations detected during the September 1997 sampling event generally increased from the July 1997 sampling event. Benzene concentrations were detected in samples obtained from MW-2, MW-3, MW-6, and MW-7. Benzene concentrations in excess of the benzene MCL (5 µg/L) were detected in MW-3 and MW-7.

Ethylbenzene was detected in MW-3 and MW-7. Ethylbenzene concentrations in excess of the ethylbenzene MCL (680 µg/L) were detected in MW-7.

Xylene was detected in MW-3, MW-6, and MW-7 and in excess of the xylene MCL (440 µg/L) in MW-7.

1,2-DCA was not detected in the groundwater samples analyzed.

Offices of The Terracon Companies, Inc.

Environmental Engineers and Scientlate

Arizona 🖷 Arkansas 📹 ChiniAdo 🐞 Idaho 📳 Illinois 🖏 Iowa 🖫 Kansas 📹 Minnoyota 🐞 Missoon

Montaria 👚 Notifiacka 👚 Nevada 👚 New Mexico 🚍 Oklohoma 🚍 Tonnossico 🚍 Toxaa 🚍 Ulub 🚍 Widconsin 🚍 Wyoming

Fina # 3058 Project No. 52975059 November 10, 1997 Page 2

Terracon

MtBE was detected in MW-2, MW-5, and the Existing Well.

Naphthalene was detected in MW-3, MW-8, and MW-7 and above its MCL (143 μ g/L) in MW-7.

Distribution of the impacted groundwater from the September 1997 sampling event appears to be consistent with previous sampling events.

The on-site 6-inch diameter Existing Well was observed to be located beneath a kerosene AST and does not have an expansion plug well cap or metal manhole lid. This well could provide a potential pathway for a surface release/spill from the AST to enter the subsurface. During the next monitoring event, Terracon recommends installing an expansion cap and manhole lid on this Existing Well.

Water generated from well purging activity was processed through a 55-gallon drum of activated carbon and the treated water discarded on the ground on-site.

We anticipate the next sampling event to occur in January 1998.

2.0 GENERAL COMMENTS

The results obtained represent conditions at the times and locations sampled. Sampling at different times and locations may yield different results.

Terracon appreciates the opportunity to provide environmental engineering services to KDHE and Fina Oil and Chemical Company. Should you have any questions concerning the above information or other aspects of this project, please contact us.

Sincerely,

TERRACON ENVIRONMENTAL, INC.

Mićhael Nash

Environmental Engineer

Kenneth C. Wallace, RG

St. Project Manager

cc: Greg Ferris - Fina Oil and Chemical Company

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GROUNDWATER POTENTICMETRIC CONTOUR LINE

C.1 - 0.5 Ft.

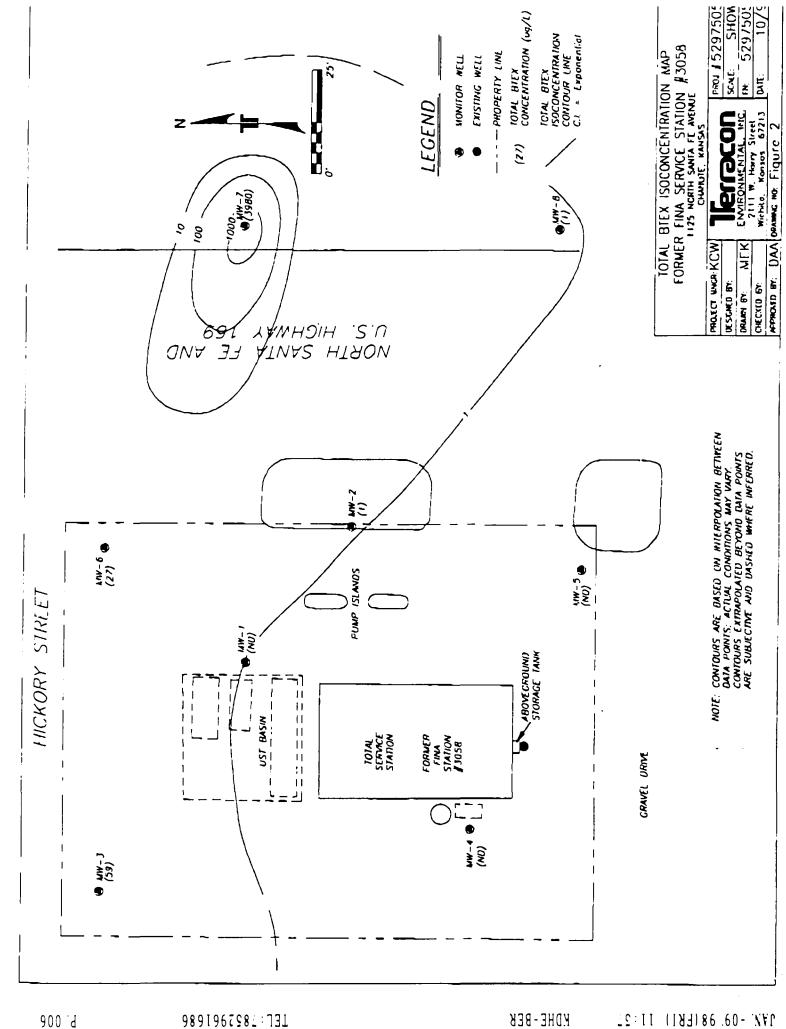
- FROPERTY LIVE GROUNDWATER ELEVATION (FL.)

12.77

EXISTING WELL MONITOR WELL

25.

CROUNDINATER



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Fina 3058 Terracon No. 52975059

E 2	Z: HISTO		CAL GROUN	DWATER (ABORATO	RY. RESUL TOTAL	15.00		HAPH-
		BENZENE (vg/l)	TOLLIENE (wa/l)	BENZENE	XYLENE	6TEX	12-DCA	MTBE	THALENE
-8/14/95 ND(0.5)	ND(0.	20	ND(1)	ND(1)	NO(3)	0 S	ND(1)	2.6 NO(4)	ND(0.5)
	ND(0.5)		ND(C)	ND(1)	(f)	2	E CON	E CON	ND(1)
*9/14/95 31 7/17/97 0.6	31	T	ND(1)	5.6 ND(1)	ND(3)	37	ND(1)	15	ND(0.5)
0.7	0.7		ND(1)	ND(1)	(C) (C) (C)	• •	CON CON	. &	(E) (C) (C) (C) (C) (C) (C) (C) (C) (C) (C
*9/14/95 1.6 7/17/97 5.4	1.6 5.4		3.8 5.8	2.5 ND(1)	ND(3)	8 13	ND(1) ND(1)	15	ND(0.5)
9/9/97 18	8 4		7	55	12	89	ND(1)	ND(1)	.
-9/14/95 ND(0.5)	ND(0.5) ND(0.5)		ND(1) ND(1)	ND(1)	ND(3) ND(1)	S S	ND(1)	ND(1)	ND(0.5)
	ND(0.5)		ND(1)	ND(1)	ND(1)	Q.	ND(1)	ND(1)	ND(1)

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Fina 3058 Teiracon No. 52975059

	TABLE	2. HISTOR	TABLE 2: HISTORICAL GROUNDWATER LABORATORY RESULTS.	DWATER L	ABORATO	RY RESUL	.15		4 4 4 4 3
	DATE	RENTENE	TOUR	ETHYL	3.0	TOTAL			NAPH
LOCATION	SAMPLED	(ngr)	(vg/l)	(vg/)	ATLENE (ug/l)		12-0CA (193)		THALENE (597)
MW-5	*8/14/95	ND(0.5)	(1) an	(1) (1)	ND(3)	QN	(1)QN	ND(1)	ND(0.5)
	787717	ND(0.5)	NO(1)	ND(1)	Ç Q	2	(î)	<u>Ç</u>	ND(1)
		MC(0.3)	(DON	(1) ND(2)	(t) Qu	<u>Q</u>	NO(1)	4	ND(1)
MW-6	7/117/97	2.7	20	ND(1)	5.8	29	ND(1)	(1) (1)	0.56
	16/6/6	3.2	17	ND(1)	9.3	27	ND(1) ND(1)	ND(1)	1.6
)-MM	78/14/95	1200 800	490 270	1400 850	1400 790	4490 2710	(01)QN (92)	ND(25) ND(10)	74 250
	16/6/6	1200	380	1200	1200	3980	ND(5)	ND(5)	320
8-WW	7/17/97	ND(0.5) ND(0.5)	ND(1)	ND(1) ND(1)	ND(3) ND(1)	ON ON	ND(1) ND(1)	ND(1) ND(1)	ND(0.5) ND(1)
		(60)	-	Ĉ	(t)	-	(L)QN	(E) Q	(£)

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Fina 3058 Тепасоп No. 52975059

13 by 13 co	TABLE	Z: HISTOR	TABLE 2: HISTORICAL GROUNDWATER LABORATORY RESUL	IDWATER L	ABORATO	RY RESUL	13	20.4.3.3	1000000
				ETHYL		TOTAL			MAPA
		BENZENE	TOLLIENE	BENZENE	XYLENE	BITEX	12-DCA	MTBE	THALENE
LOCATION	SA	(J6a) ·	(ngn)	(Lygh)	(Ngu)	(6a)	(60a)	(Lon)	<u>[567</u>]
EXISTING	S	ND(0.5)	ND(1)	(1)QN	(c)ON	Q.	(1)QN	ND(1)	ND(0.5)
WELL	/6//L//	ND(0.5)	ND(1)	ND(1)	(E)QN	2	(E)QN	1.2	(i) N
	/6/6/A	ND(0.5)	ND(1)	ND(1)	E)QN	2	(E)QN	1.9	ND(1)
KNL		0.5	100	68	2	U.V	0.5	I N	HV
MCL		5	1000	680	440	¥	5	Į Ľ	143
								!	

ugA = micrograms/Rer, roughly equivalent to parts per billion ND(X,x) = not detected, detection fimits in paranthesis

NA = not analyzed

KNL = Kansas Notification Level

MCL = KDHE Maximum Contaminant Level

NE = Not Established

* Information taken from Site Assessment Report prepared by Gereghty & Miller dated May 1996

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Fina 3058 Terracon No. 52975059

	TABLE 1:	Historical Gro	undwater Ele	vations (Fee	1)
Location	Date	TOC	DTP below		GW
	Measured	Elevation ¹	TOC ²	TOC ²	Elevation
MW-1	*9/14/95	915.49		2.02	913.47
	7/17/97			0.91	914.58
	9/9/97			1.31.	914.18
ļ		}			
	<u>'</u>				
MW-2	*9/14/95	915.96		3.18	912.78
	7/17/97			2.18	913.78
	9/9/97	:		2.56	913.40
					ı
					,
MW-3	*9/14/95	915.80		1.66	914.14
M144-2	7/17/97	915.60		1.29	914.51
	9/9/97		ĺ	1.09	914.71
	0,3,3,				0 14.7
			l	1	
,					
MW-4	*9/14/95	917.61	Ì	3.38	914.23
	7/17/97		}	1.98	915.63
	9/9/97			2.88	914.73
		Ì			
	İ				
MW-5	*9/14/95	915.66		2.81	912.85
·	7/17/97			1.74	913.92
	9/9/97			2.53	913.13
Ì					
		1			
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Fina 3058 Terracon No. 52975059

100000000000000000000000000000000000000	TABLE 1:	Historical Gro	undwater Ele	vations (Fee	() 1000 1000 1000 1000 1000 1000 1000 10
Location	Date	TOC	DTP below	DTW below	GW
	Measured	Elevation 1	TOC ²	TOC ²	Elevation
MW-6	*9/14/95	915.82		3.31	912.51
1	7/17/97			2.78	913.04
}	9/9/97			3.05	912.77
1					
1					
ŀ		•		}	
MW-7	*9/14/95	914.75		3.87	910.88
14144-1	7/17/97	514.75		2.24	912.51
	9/9/97			2.86	911.89
	3,3,3,			2.00	3 1 1 . 3 3
		. <u></u> <u></u>			
MW-8	•9/14/95	913.70	İ	2.89	910.81
	7/17/97			1.23	912.47
	9/9/97			1.84	911.86
]		[
}	·]			
EXISTING	NA	NA NA	NA	NA	NA NA
WELL	7/17/97	170	170	2.23	NA NA
*****	9/9/97			2.74	NA NA
		}			
	. }				

Notes:

NA = Not Available

¹⁾ Top of Casing (TOC) elevation determined by registered land surveyor and expressed as feet above mean sea level.

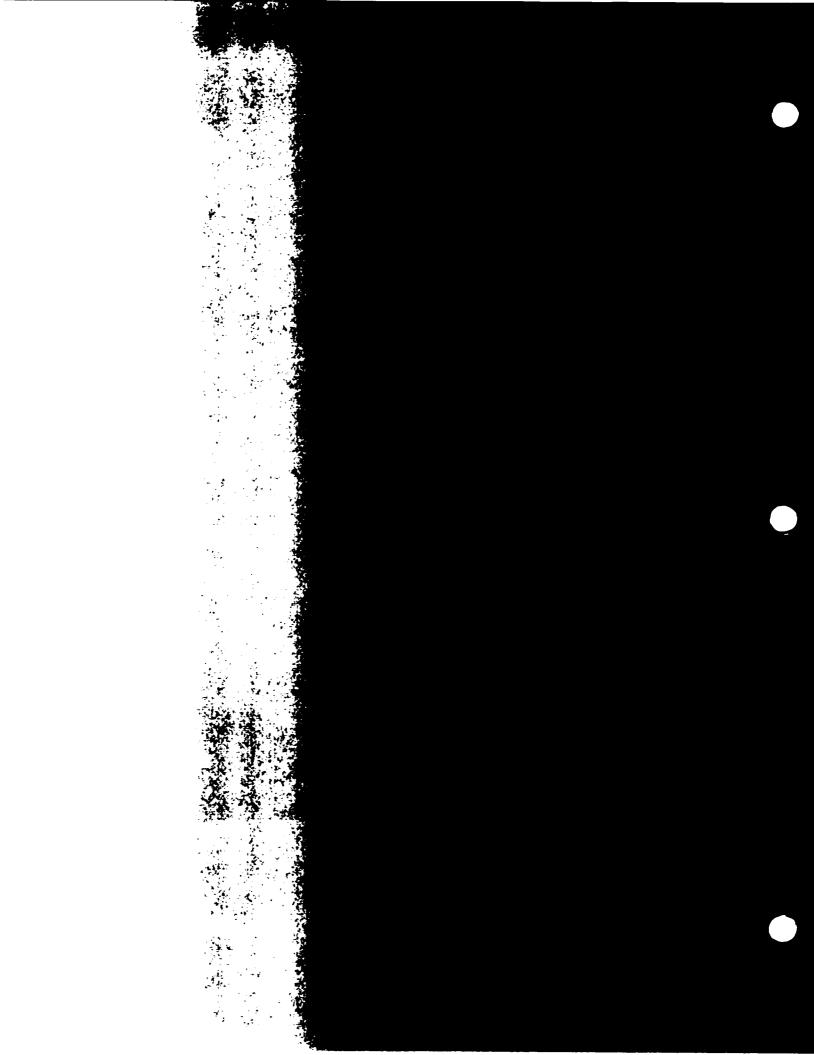
²⁾ Depths to groundwater/product (DTW/DTP) determined using an CRS Hydrocarbon Interface Probe.

^{*} Information taken from Site Assessment Report prepared by Geraghty & Miller dated May 1996.

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MAY 1996 KDHE GROVATER SAMPLING RESULTS

January 1998 973-2300.7





KANSAS HEALTH & ENVIRONMENTAL LABORATORY Department of Health and Environment

Forbes Field, Bldg. 740, Topeka Rans (\$ 65520)



REPORT OF ANALYSIS MAY 1 4 1996

ORGANIC CHEMISTRYBUREAU OF ENVIRONMENTAL REMEDIATION

Report To: TOM PETERSON-BER

Address: FORBES FIELD, BLDG 740,

TOPEKA, KS 66620

Lab Number: 604217VX

Date Rec'd: 05/03/96

Report Date: 05/10/96

Site ID No.:

Acct No:

Sample Type: WATER

Program Code: EW

Site: MW-1 - MARCO, CHANUTE

Depth:

No. Composited: 0

Collected By: KDHE S. STOVER/F. ARNWINE

Date: 05/02/96 Time: 13:10

PRIORITY POLLUTANT VOLATILE ORGANIC COMPOUNDS	CONC.	ENTRATION ug/L)	Analysis Date	EPA Method
VOLATIBE ONGANIC CONTOUNDS				190 01100
Chloromethane	<	5.0	05/08/1996	624
Bromomethane	<	1.2	05/08/1996	624
Vinyl Chloride	<	0.8	05/08/1996	624
Chloroethane	<	3.7	05/08/1996	624
Dichloromethane	<	0.9	05/08/1996	624
1,1-Dichloroethylene	<	0.6	05/08/1996	624
1,1-Dichloroethane		0.6	05/08/1996	624
trans/cis 1,2-Dichloroethylene as trans	<	0.5	05/08/1996	624
- Trichloromethane (THM)	<	0.5	05/08/1996	624
1,2-Dichloroethane	<	0.5	05/08/1996	624
1,1,1-Trichloroethane	<	0.6	05/08/1996	624
Tetrachloromethane	<	0.7	05/08/1996	624
Bromodichloromethane (THM)	<	0.5	05/08/1996	624
1,2-Dichloropropane	<	0.5	05/08/1996	624
trans 1,3-Dichloropropene	<	0.8	05/08/1996	624
Trichloroethylene	<	0.6	05/08/1996	624
Benzene		296	05/08/1996	624
Dibromochloromethane (THM)	<	0.7	05/08/1996	624
cis 1,3-Dichloropropene	<	0.9	05/08/1996	624
1,1,2-Trichloroethane	<	0.6	05/08/1996	624
Bromoform (THM)	<	1.5	05/08/1996	624
1,1,2,2-Tetrachloroethane	<	0.6	05/08/1996	624
Tetrachloroethylene	<	1.1	05/08/1996	624
Toluene		31.3	05/08/1996	624
Chlorobenzene	<	0.5	05/08/1996	624
Ethylbenzene		3.7	05/08/1996	624
Xylene		21.0	05/08/1996	624
1,3-Dichlorobenzene	<	1.0	05/08/1996	624
1,2-Dichlorobenzene	<	1.0	05/08/1996	624
1,4-Dichlorobenzene	<	1.0	05/08/1996	624

Comment: Many petroleum type hydrocarbons were indicated.

Chemist: Richard L. Pierce

(913) 296-0971

< - Not Detected at Indicated Level.

gut sample

Env. Microbiology

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KANSAS HEALTH & ENVIRONMENTAL LABORATORY Department of Health and Environment Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001



REPORT OF ANALYSIS

ORGANIC CHEMISTRY

Report To: TOM PETERSON-BER

Address: FORBES FIELD, BLDG 740,

TOPEKA, KS 66620

Lab Number: 604218VX

Date Rec'd: 05/03/96

Report Date: 05/07/96

Site ID No.:

Acct No:

Sample Type: WATER

Program Code: EW

Site: MW-3 - MARCO, CHANUTE

No. Composited: 0

Collected By: KDHE S. STOVER/F. ARNWINE Depth: Date: 05/02/96 Time: 14:30

PRIORITY POLLUTANT VOLATILE ORGANIC COMPOUNDS	CON(CENTRATION ug/L)	Analysis Date	EPA Method
Chloromethane	<	5.0	05/06/1996	624
Bromomethane	<	1.2	05/06/1996	624
Vinyl Chloride	<	0.8	05/06/1996	624
Chloroethane	<	3.7	05/06/1996	624
Dichloromethane	<	0.9	05/06/1996	624
1,1-Dichloroethylene	<	0.6	05/06/1996	624
1,1-Dichloroethane	<	0.5	05/06/1996	624
trans/cis 1,2-Dichloroethylene as trans	<	0.5	05/06/1996	624
Trichloromethane (THM)	<	0.5	05/06/1996	624
1,2-Dichloroethane	<	0.5	05/06/1996	624
1,1,1-Trichloroethane	<	0.6	05/06/1996	624
Tetrachloromethane	<	0.7	05/06/1996	624
Bromodichloromethane (THM)	<	0.5	05/06/1996	624
1,2-Dichloropropane	<	0.5	05/06/1996	624
trans 1,3-Dichloropropene	<	0.8	05/06/1996	624
Trichloroethylene	<	0.6	05/06/1996	624
Benzene	<	0.5	05/06/1996	624
Dibromochloromethane (THM)	<	0.7	05/06/1996	624
cis 1,3-Dichloropropene	<	0.9	05/06/1996	624
1,1,2-Trichloroethane	<	0.6	05/06/1996	624
Bromoform (THM)	<	1.5	05/06/1996	624
1,1,2,2-Tetrachloroethane	<	0.6	05/06/1996	624
Tetrachloroethylene	<	1.1	05/06/1996	624
Toluene	<	0.5	05/06/1996	624
Chlorobenzene	<	0.5	05/06/1996	624
Ethylbenzene	<	0.7	05/06/1996	624
Xylene	<	0.6	05/06/1996	624
1,3-Dichlorobenzene	<	i.o	05/06/1996	624
1,2-Dichlorobenzene	<	1.0	05/06/1996	624
1,4-Dichlorobenzene	<	1.0	05/06/1996	624

Chemist: Richard L. Pierce

gent sumply

< - Not Detected at Indicated Level.

RECEIVED

Environmental Laboratories

Inorganic Chemistry (913) 296-1657 (913) 296-1647 Organic Chemistry Radiochemistry

(913) 296-1629 Env. Microbiology (913) 296-0971

Roger H. Carlson, Ph.D., Director - (913) 296-1620 Laboratory Information and Reporting - (913) 296-1627 Laboratory Fax - (913) 296-1641

Heath Lagrantes
Diagnostic Micro. (912) Serology Virology

(913) 296-1636 (913) 296-1651 (913) 296-1653 (913) 296-1645

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		<u></u>



KANSAS HEALTH & ENVIRONMENTAL LABORATORY Department of Health and Environment

Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001



REPORT OF ANALYSIS

ORGANIC CHEMISTRY

Report To: TOM PETERSON-BER

FORBES FIELD, BLDG 740, Address:

TOPEKA, KS 66620

Collected By: KDHE S. STOVER/F. ARNWINE

Lab Number: 604219VX

Date Rec'd: 05/03/96

Report Date: 05/07/96

Site ID No.:

Acct No:

Sample Type: WATER

Program Code: EW

Site: MW-4 - MARCO, CHANUTE

Depth:

No. Composited: 0 Date: 05/02/96

Time: 14:10

PRIORITY POLLUTANT VOLATILE ORGANIC COMPOUNDS	CONC	CENTRATION ug/L)	Analysis Date	EPA Method
Chloromethane	<	5.0	05/06/1996	624
Bromomethane	<	1.2	05/06/1996	624
Vinyl Chloride	<	0.8	05/06/1996	624
Chloroethane	<	3.7	05/06/1996	624
Dichloromethane	<	0.9	05/06/1996	624
1,1-Dichloroethylene	<	0.6	05/06/1996	624
1,1-Dichloroethane	<	0.5	05/06/1996	624
trans/cis 1,2-Dichloroethylene as trans		4.2	05/06/1996	624
Trichloromethane (THM)	<	0.5	05/06/1996	624
1,2-Dichloroethane	<	0.5	05/06/1996	624
1,1,1-Trichloroethane	<	0.6	05/06/1996	624
Tetrachloromethane	<	0.7	05/06/1996	624
Bromodichloromethane (THM)	<	0.5	05/06/1996	624
1,2-Dichloropropane	<	0.5	05/06/1996	624
trans 1,3-Dichloropropene	<	0.8	05/06/1996	624
Trichloroethylene	<	0.6	05/06/1996	624
Benzene	<	0.5	05/06/1996	624
Dibromochloromethane (THM)	<	0.7	05/06/1996	624
cis 1,3-Dichloropropene	<	0.9	05/06/1996	624
1,1,2-Trichloroethane	<	0.6	05/06/1996	624
Bromoform (THM)	<	1.5	05/06/1996	624
1,1,2,2-Tetrachloroethane	<	0.6	05/06/1996	624
Tetrachloroethylene	<	1.1	05/06/1996	624
Toluene	<	0.5	05/06/1996	624
Chlorobenzene		1.0	05/06/1996	624
Ethylbenzene	<	0.7	05/06/1996	624
Xylene	<	0.6	05/06/1996	624
1,3-Dichlorobenzene	<	1.0	05/06/1996	624
1,2-Dichlorobenzene	<	1.0	05/06/1996	624
1,4-Dichlorobenzene	<	1.0	05/06/1996	624

Chemist: Richard L. Pierce

(913) 296-0971

< - Not Detected at Indicated Level.

RECEIVED

Environmental Laboratories

Env. Microbiology

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Roger H. Carlson, Ph.D., Director - (913) 296-1620 Laboratory Information and Reporting - (913) 296-1627 Laboratory Fax - (913) 296-1641

HEADY RONATION HEADY RATE PARTY PART

Virology

Neonatal Screening Serology

(913) 296-1636 (913) 296-1651 (913) 296-1653 (913) 296-1645

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APPENDIX C PHASE I FIELD REPORTS

			J
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		,	

	ER ASSOCIATES on Blvd., Suite 100	DATE 12/8/97	973-2300.4
	Colorado 80228-1830	FRUJECT KDHE/MARC	
(20	03) 980-0540	LOCATION	
•		MID-AMERICA REFINELY	OWNER CHANCE
· K	-DHE	HydeoLOGIC TAX.	TEMP • at A
		CAN RAIN PRESENT AT SITE	35 ° at 3'00 P
		MKELLER	
THE FOLLOWING WA	S NOTED	h. warch	
	JE IN CLANUTE. MEST		WHE South
) (STRI	CT OFFICE TO PICK-UP M	ARCO KEYS.	
1530 HEI	with FOTT & GERICKE	RETS TO DISCUSS Play	ENERT OF
DRILL	LOVATION FAGS.		
1600 0-1	TY. LUCKTURS ON SITE!		
	ZGE - FARSONS -	RINDY LYKE	
	EGE-FARSONS - -c'ephone Optic -	- Iway Johnson	
	CITY DWHED GAS -	- PAVE ?	
REMA	WAR OF UTITES WILL	be classo - Tomorow	,
1700 WAG.	- with Ash wrime and	LURKY'S REPS FINI	sh
		· -in fra.	
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1800 LF	FAVE STE		
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OPIES TO			
		SIGNED W. G. FR	

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GOLDER ASSOCIATES 973-2300.4 200 Union Blvd., Suite 100 Lakewood, Colorado 80228-1830 KDHE /MARCO C.I/KS (303) 980-0540 MID-AMERICA REFINERY CO.; CLANUTE, KANS. CONTRACTOR HyseoLOGIC IN. KILLE 38 at 7:30 AN 33 "at 1730 PM PRESENT AT SITE R. Mrch M. KELLUTZ J. JAIRES D. Zurney THE FOLLOWING WAS NOTED MARIO ENTINUCE (0) 08,00 MRE from Ash Gride FIX L'ASP PEVEN. 1:00 PENAMERA I ACCESS TO SELL SITE I MATERIAS CN GATE PUSOUNC PID AND HUDAC PHICOND METER SLMDE FID-S-1 -5€ - 1 - 1 · -- . ; PREJSAL & PRIVOSE マケラ MINITIMELL TALL FOR E FOR CONTETES 17.20 1. Noch 125 ₽_ . ¥ -c- - 30 P7-5-1 51.1111 4.0 1450 Vice (0)5 MINI-WELL SOLW DENE OFMENT OF P-18 115 No Yollinge 5 GALS SUCH WE AW> lare - Lec THE MAKEN IN THE (NOW THERET 1016 €,,-€ 1730

FINELLD REEPORT OPIES TO _

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M.KELLER

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20	OUDER ASSOCIATES OUTION Blvd., Suite 100	DATE 12/10/97	973-2300.4
Lake	wood, Colorado 80228-1830	KDHE/MARCH	o C.I/KS
	(303) 980-0540	MID-AMERICA REFINERY	Co.; CLANUTE, KANS
. ~	K. :4	HyperLOGIC INC.	OWNER
		Chile / Or	TEMP 32 * at 735 AV 38 * at 7633, PM
		PRESENT AT SITE	D. Dy' KMY
		W KELIER	5. Kinth
			J. Inines
THE FOLLOW!	NG WAS NOTED		
० हिन	10 formble heration Pac		
0800	President Page Conce	ex 0 15 well some	1 1/2
	FRIL HENNES (COST) ON SITE	· ro mac sit in	Sujec
	CRUPE 13-5-1 -ALEN No		
13:50	FILL LIMES (SEP STO SET)		
	pacence.		
	FRANCE WAS FORE TOWN		
	bearing the contract		•
+ 23 G	Es Botalia f-8		
1315	i ii pul hiā in	Cirolo E 3' color	
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	simple the property of	Spire on Co.	
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· • · · · · · · · · · · · · · · · · · ·	With the property		<u> </u>
Tergery 4	14 / Ca	Some Marie Commence	A TOTEL AROUS
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OPIES TO		FIRELID R	
J. 10		SIGNED NEW SIGNED	
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	Lakewood, Colorado 80228-1830		KDHE/MARCO C.I/KS		
		(303) 980-0540	LOCATION	Necy Co.; CLANUTE, KAN	
1.		KDHE	LYDE LOGIC	OWNER	
			WEATHER SNOW/(C.) PRESENT AT SITE	TEMP 31 OTBO AN	
_		816-591-4136	MIGUIFE		
		•		J Jacobs	
THE FO	LLOWING	S WAS NOTED			
	730	MEET ILLI @ MARIO GATE, 1	LARGE Mobil Leb wice	Not be able to	
		Mal TO SITE, Soupies for Dri			
		the Lab.	•		
	0815	@ P-11 CONTINUE, Calibrate	MINITA M-1000 PID S	Hyme Pube to	
		Current @ 175 PULL SCOREN		,	
	- 2115	lieve 70 p-10 minimient was	· · · · · · · · · · · · · · · · · · ·		
		STERRINE SAMPLE FIO-W-1.			
·	ගාප	a Forthir P-12 Ext up	PRFICEL @ 21	1	
1	130	SET WELL, & complete			
	24 5	Likelep WELL By freging 5 asm	, VOL (34 GAL) full s	Note f12-W-1 @ 1310	
_ 	345	Lunch			
} 4	145	6. Bourie P-19 set ip	THE TO DEFINAL O	6. Z1º-	
15	540	SET WELL & COMPLETE			
' /	5 40	Develop was By Puema 7 25.	No VOL (5 garins) 1	VIL SAMPLE FIG-W-1 @ 165	
1-	710	Ser up @ P-17, Ser up	Done - Cafusal	@ 25 - Smple P17-5-1	
15	 Boo	Sample PIT-W-1 pullers.			
	330	LENCE SITE			
			โลงเกลงเ เก	RIEPORT	
OPIES	то			ENERT OF WATE	
			CICNED IVI. IC	e	

SIGNED _

973-2300.4

12/11/97

GOLDER ASSOCIATES

200 Union Blvd., Suite 100

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GOLDER ASSOCIATES 200 Union Blvd., Suite 100	OA.	12/12/97	973-2300.4
Lakewood, Colorado 80228-1830	PRI	KDHE/MARCO	
(303) 980-0540	l Ma	CATION N-AMPRICA REFINERY	Co.: CLANUTE KANS
KTHE	cor	HYPACTOR HANDLOCALC TAX	TEMP 79 *at 073 CAM
	we.	ATHER	TEMP 79 . at 073 CAN
		M. CE ' Re	P. LAX
NE SOLI OUUNO WAS NOTED			5 KNOPP
HE FOLLOWING WAS NOTED	L_		MILE
0730 @ Mercs 5012	HLT Lowing supplies	s Decon Fig)
0820 @ P-14 = AT UP	College Hypac/	Photovac mil	PIU-C-1 8 NOT BA
1000 SET & COMPLETE W	ELL		
1030 FURE 5 GRANN VOL (24	gus) & collect su	ceraing ([14-w-1) &)	rupe (114-11-18) sayle
1:00 @ P-Ko, 5x7 up 1	THE TO REPUSAL @	22 = SWI'E	1-51 -KIAL @ 30-
1230 Ext & COMPRETE UN	ell		
1320 (maj 5 125.00 Vol 1	a 4 mls) & sizes	SCHENNO SAMPR	1612-W-1)
DE DON		/	
1400 Egypte			
1500 @ P-2 FEUF	1/1. LL -0 PAGE	N. @ 712 SAN	40 PS-5-1 00 35
1630 EFT & CHARA 4			†
1700 @ P-1 < = - UP		1 D 7.2	
1755 P. L. STAFFITHS SCA			
1800 à f-2 -more P	1		. 11. 2 823
120 120 Car 12 12	Shirt X - E		
	-		
PIES TO		TELID R	
	SIGN	11 /6110	

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2	00 Union Blvd., Suite 100	12/0///	973-2300.4	
Lake	ewood, Colorado 80228-1830	KDHE/MARCO C.I/KS		
	(303) 980-0540	MID-AMERICA REFINE	ey Co.; CLANUTE, KANS	
10	KINE	HYDEOLOGIC I	NC.	
		WEATHER SUNN / (N) PRESENT AT SITE	TEMP 72 OF DAN 38 OF GOODEN	
		M. KELLEZ	D. Nulaufy	
			f from S. Knift	
THE FOLLOW	ING WAS NOTED		S. Knift	
0730	1 m > 1 con			
59,00	(D) Bockbie P-6 Pril	E TO Extrisal @ 35 NO	142 TO 15 5	
	callber Hymas & photos			
0600	SET & COMPETE WELL, E.	whole pur souple 16-1	,-1	
5°50	D Rocehola P-4 stire			
1.55	SET S SOMETE WELL TO		11 (a) 1141	
<u> </u>	(4 to 14 to N			
1.30	à firelie (-5, pale	F TO EXPOSE (2) 113	renze for 5-5-1, fow-	
1300	(a) Boselule F-3, people.	6 6 4 6 0 - 5 WI	samples P3.5-1, F3-W-1 2 P3-W-15 @ 1405	
	Aborton Hele			
:400 -	1450 Linch			
1500	@ Borehule P-15, france =	U PERISH @ 230 KNS	P15-W-17 @ 1600	
··	MART WITH GARY WELLCOR SO	everoc) R Loure Porchde	s for Him.	
1:00	<. will pulie & scrap	E MI, MR, C MY ON	varus SITE	
1/ 30	@ Bucho'r F-20, probe	TO [Esugal as = 1	8 Pro-W-12 @ 1720	
	the low Area from the Merce			
	(Netapas Privary for CAMEMINA	IT MIGHTIN, FOU WAS	or for the trees	
	CINTAL NATED LOCATION ObserveD.	FLAR PHINT WAS DISENSED	on july Equipment &	
	IN ACUNDWATER, DECUN R	<u> </u>		
:~V	@ Buchole P-13, public To	· Refusal @ 195 PV 30	MG 85 F13-5-1 & p13-60-	
19シン OPIES TO_	Sayle MI, following prexe	TETUETUD T	RIEIPOIRT	
2030	LEAVE SITE	SIGNED JULES		

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	GOLDER ASSOCIATES 200 Union Blvd., Suite 100	DATE 12/14/97	973-2300.4
	Lakewood, Colorado 80228-1830		O C.I/KS
	(303) 980-0540	MID-AMERICA REFINELY	
۱.	KNYE		
-	C 12	HypelOGIC INC. WEATHER C FUR / COTOL	TEMP 30 at 800 A
			45 at 1230P
_		M. KE LEE	
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ME FO	DLLOWING WAS NOTED		
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·····	300 - @ MARCO SIFE, MICINO		
 .	ALL WELL LOCTIONS FO V		ions d
	If web LATEST WATER LENE	-15.	
	^		
	1000 - Lock @ P-7 will NOT	COME OFF, CUT LOCK	٤ ا
	regions with Lock From	van P-2.	
		·····	
	1/00 - PROTECTIVE POSTS FOR WEL	LS P-7 & P-9 H	WE NOT
	BASEN SET WILL ASK	HLI TO COMPLETE	= Those
	& put New Lock ON	P-2.	
	LEAVE SME		
			
<u> </u>		····	
_		האווה היה	1210\0\10\10
OPIES	то	FILEILIDIR	
		SIGNED M. LECCE	<u> </u>

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APPENDIX D REPRESENTATIVE PHASE I PHOTOGRAPHS

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PHOTO D-IA: DIRECT PUSH PROBING AT P-7



PHOTO D-IB: EXTRUDED SOIL CORE AT P-12

Golder Associates	REPRESENTATIVE PHASE I PHOTOGRAPHS	S
KDHE MARCO INVESTIGATION	CHECKED SCALE DWG NO /REV NO	73-2300 A029
	RSM FILE NO 2300A029 FIGURE NO	D-I



PHOTO D-2A: MINI-WELL INSTALLATION AT P-9

REPRESENTATIVE PHASE I PHOTOGRAPHS

Golder Associates

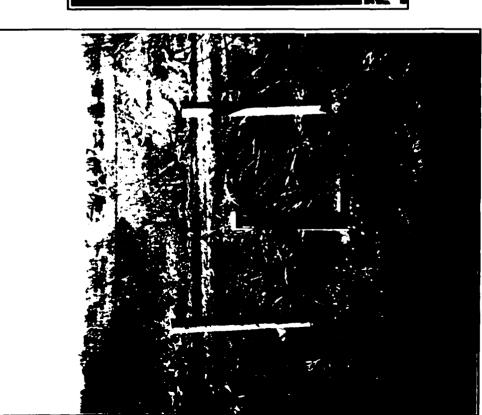
MARCO INVESTIGATION

ZAVA C	S	DATE	IANI JARY 1998	00 800
۵	MIK	SCALE	∀ /Z	DWG NO MEY NO
	SX M	FILE NO	2300A030	FIGURE NO

A030 D-2

973-2300

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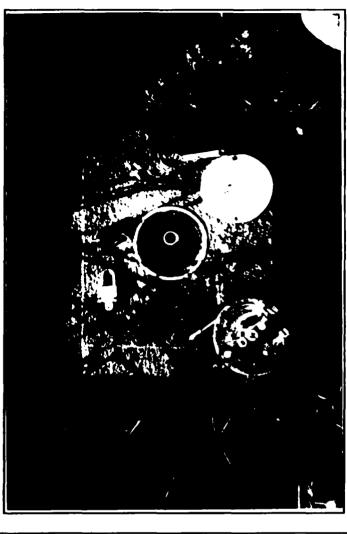


PHOTO D-3B: FLUSH-MOUNT MINI-WELL COMPLETION AT P-10

PHOTO D-3A: ABOVE-GRADE MINI-WELL COMPLETION AT P-18

G Golder Associates	<u>.</u>	REPRESENTATIV	REPRESENTATIVE PHASE I PHOTOGRAPHS	OGRAPHS
CLIENTPROJECT	DRAWN	DB DATE	IANUARY 1998	008 ₩O
MARCO INVESTIGATION	CHĒĆĶED	MJK SCALE	A/Z	DWG NO REV NO
	REVIEWED	RSM FILE NO	2300A031	FIGURENC

0-3 A031 973-2300

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APPENDIX E SOIL BOREHOLE LOGS

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SOIL CLASSIFICATION CHART

MAJ	OR DIVISI	ONS	GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL DESCRIPTIONS
	GRAVEL AND	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
COARSE	GRAVELLY SOILS	(LESS THAN 5% FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES
GRAINED SOILS	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
,		(MORE THAN 12% FINES)		GC	CLAYEY GRAVELS, GRAVEL—SAND—CLAY MIXTURES
MORE THAN 50%	SAND AND SANDY	CLEAN SAND		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SOILS	(LESS THAN 5% FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	LESS THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND-SILT MIXTURES
	NO. 4 SIETE	(MORE THAN 12% FINES)		SC	CLAYEY SANDS, SAND-CLAY MIXTURES
	SILTS			ML	INDRGANIC SILTS AND VERY FINE SANCS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
FINE GRAINED SOILS	AND	LIQUID LIMIT MORE THAN 50%		CL	INDRGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	CLATS			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50%	SILTS			мн	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	AND	Timil diuou 203 naht 2231		СН	INDRGANIC CLAYS OR HIGH PLASTICITY, FAT CLAYS
	CLAYS			ОН	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIG	SHLY ORGANIC SOIL	s		PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

Golder Associates Denver, Colorado	THLE	CL		NIFIED SO	JIL MATSYS	
CLENT/PROJECT	DRAWN	RB	DATE	JAN. 1998	JOB NO 973	-2300.7
KDHE	CHECKED	MJK	SOALE	N.T.S.	DWG NO /REV. NO	A032
MARCO INVESTIGATION	REVIEWED	RSM	FILE NO	23004032	FIGURE NO.	E-1

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FIELD LOG - SOIL BOREHOLE											
SITE NAME AND LOCATION DRILLING METHOD: DIRECT PUEH BORING NO.											
KDHE/MARCO CI/KS (GEORGHE Ru) P-3											
973-2300.4 SHEET	,]										
973-2300.4 SHEET SAMPLING METHOD: CONTINUOUS / OF Z											
MID-AMERICA REFINERY CO. SITE SAMPLING USING 48" CORE TUBES DAILING											
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(32-757) FIRM, DARK											
(3 ² -75?) FIRM DARK GRAY (N3), SITY Clay, TOLE F- NED SAND, SUPLE P3-S-1 TEKEN @ 3 ²											
Truce F- MED SAND, A = Suple P3-S-1 Taken @ 32											
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GE-757) FIRM DARK GRAY (NB), SITY CLAY, TRICE F- NED SAND, DAMP TO WET (CL) (CL) (T5?-185) FIRM TO STIFF, MOTTLED DARK YEllowISH OLANGE (10 YR 66) FO DARK OLANGE (10 YR 66) FO DARK											
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		FIELD	LC	OG	_	SOI	LB	OF	REHO	DLE				
SITE	NAME AND LOCATION KDHE / MARC	0 (T / V S	DP	ILLING	MET				PUEH		BORING	NO. Z ()		
	973-7	300.4	-			(6€	opeobl	E)	29)		SHEET	20	انيا	ı
1	,,,,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	SA.	MPLIN	G MF	THOD:					1	of Z	H	
MD	-AMERICA REF	incey Co. SITE							ORE TI	.he.		LING	{ `` }	
	•					USW	3 7	<u> </u>	Olar 1	<u> </u>	START	FINISH	1	
				TER L		NERS 3º				T	TIME	TIME	181	
			\ '''	TIME		170					1635	1720		
}	A 11 22 40			DATE	<u> </u>	(2/1)				1	DATE	DATE	Hyre Losic	
DATU	N: 7240 IM E: 253	913.Z ELEVATION (NOV	CA:	SING D	EPTH	•		•			12/3/9	12/13		
DRILL		Esethplose 200		SURF.	ACE	CONDITIO	ONS	Ų٨	cant l	OT BE	TW48~] +	
ANGL		BEARING				Ger	cke	8	TA.LL	Ly Pro	PERTIES] _	
SAME	LE HAMMER TORQUE	2 150 PSI FTLE	s					Ţ.]	
DEPTH IN FEET (ELEVATION)	KUN # (RECOVERY) SOUR GRANH HEL KACTIVITY	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL		SAMPLER AND BIT			FROM FEET OT		DESC	RIPTION O ANI REMA		Ю	DRILLING CONTR	
	\ <u>\(\frac{\pi}{-} \) </u>	(25-2) SOFT, DUSKY YELLOWISH BROWN (10) CLAYEY SILT LITTLE SAND, DAMP (TDP (25-2) SOFT, BROWN BLCK (SYR 21) SILT TO CLAYEY SILT, TR SAND, DAMP (ML-1 (2-12-) SOFT, MED DAKK GRAY (NY) CLAY, DAMP TO WET PF-TROLEUM SATURAT (CL (122-17-) FIRM, MO LIGHT OLULGOBY (5) TO DAKK YELLOWISH (10 YR 6/6), SILTY (CL (CL) (CL) (CL) (CL) (CL) (CL)	MAN SULLAND SU	7	- Passille file Depth	Juntu		*	PUNS RE CON LA ROT THE PROD. ACTOVAL	Z & 13º Z & 13º Z & ARE SURFAU C PID ACT ON	COMMAND COMMAND THEM PRADING PRADING 1225	NO DEELS TO PETROLEVI	LOGGED BY M. KELLER	DATECHK'D BY 7.55M

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FIELD	LC	G	_	SO	ΙL	B	OF	REH	HO	LE						
SITE NAME AND LOCATION	DR	LUNG	MET	HOD:	7	IRE		706	:H		Ţ	BORING			1	
KDHE/MMCO CI/KS 973-2300.4				(6	<u>ر</u> 40ڪ						\neg	P-	· 20	2	.	
973-2300.4			_				<u>·</u>					SHEET			H	}
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MD-AMERICA REFINERY CO. SITE		امدما	<u></u>							hes					ί.	•
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(178-84) Lower, Pale (548-5/2) 511-4 5001 (548-5/2) 511-4 5001 (549-5/2)	Die Wart					fko	O.E.	îc (₩		<u>~</u>	19-			LOGGED BY M. KELLER	DATE CHK'D BY ASA

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APPENDIX F MONITOR WELL CONSTRUCTION SUMMARIES

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~ Cultural F	<u> </u>	Well No. $P - 2$ Boring No. X-Ref: $P - 2$	
	MONITOR WELL CONSTRU		
	Survey Coords:	Elevation Ground Level	
-2 - 1		Top of Casing	10
	Drilling Summary:	Construction Time Log: Start Finish	KANSAS
- 4	Total Depth 217 Borehole Diameter 225" Casing Stick-up Height:	Task Date Time Date Time Drilling 17/12 15'' 12:25' 16:30	_
-6	Driller HyproLOGIC INC. Rig Simila MELTIPPOCE TOO	Geophys Logging Casing:	Change
	Bit(s) Z.75" DE JE DOW	Filter Placement:	OCATION
-8 -	Well Design & Specifications	Cementing: 155 17700 H	01
- · c	Basis: Geologic Log Geophysical Log Casing String (s): C = Casing S = Screen. Depth String(s) Elevation 7 105 _ 1125	Well Development: The tent of the Exercise Process Sampling	
7		Stabilization Test Data:	
- 14	Casing C1 1" 1" NC C2 Screen: S1 1" 1" IV (10 5)	Time p H Spec. Cond. Temp (C) 1800 703 7570 504 7 5 7 5 7 5 7 6 1304 7 8 7 7 7 7 5 7 7 6 231 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	
16	S2	Recovery Data: Q= S _o =	
19	Filter Pack:	H 30 E C 60 V 40 E 40	
70	Bentonite Seal: 6-11/6 13 V45 25-7	TIME ())))
002105	Comments: NAME MENTS Q	SUPPLIES OF THE PROPERTY OF TH	DAIE
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	_	well No	J	1
	1	Boring No. X-Re	f: <u>F-1</u>	1
_	MONITOR WELL CONSTRU	CTION SUMM	ARY	
	Survey Coords:	Elevation Ground L	evel	
		Top of Ca	sing	
	Drilling Summary:	Construction T	ime Loa:	
			Start	Finish
	Total Depth 223 Borehole Diameter 2.75 Casing Stick-up Height: £195h	Task	Date Time	
	Borehole Diameter 7.75	Drilling	12/13/47 0955	12/13/10
	Casing Stick-up reight:	-	- 	-
	Driller Dy AURY HYDROLOGIC INC.	-		-
		Geophys Logging		
	Rig SIM W ELPTAPHY 200	Casing:	1 1050	
	Bit(s) 7.75" Drive DINT	-		-
	Drilling Fluid	-		-
	Í	Filter Placement:	1100	-
	Protective Casing Flish Mount	Cementing: 8-7		
		Development:		- - -
	Well Design & Specifications		-1/-	- \\ -
	Basis: Geologic Log Geophysical Log		<u> </u>	-!
	Casing String (s): C = Casing S = Screen.	Well Developm	ent:	
		(ANNOD	4 21 5	Escins V
	Depth String(s) Elevation	- Truck -	4 2/10,5	
	2/47 - 1/22 - 5/	-		
	123 - O CI	-	 .	
		<u> </u>		
		Stabilization Te	st Data:	
		Time pH	Spec. Cond.	Temp (C
	Casing: C1 1 TO PIC	1137 7.08	spec. Cond.	10.1
	Casing: C1	655	J. 873	20 x
	C2	1.80	200	20 g
		1141 5.80	22 O	
	Screen: S1 1" I) NC 0.50		5 2 5	¢.2
	S2	Recovery Data:		
		Q=	s _o =	
	Filter Pack: 12-40 ART SAND	. 100		
	2187 - 105	E 80 C 60 O	 	+ + - 1
	Grout Seal:	Č 60	 	+
		V 40	 	
	Participation Control Control (1997)	E R 20		
	Bentonite Seal: ENVIRONITE IIA ALT	`		
	10°-1°	20	40 60	80 100
1		TIME	()	
J		<u> </u>		
	1	P. c. =		
	Comments: LICKLOCKURS	RES		
	Comments: LICKLEAUGES	RES		

		Well No. P-6	_
	MONITOR WELL CONSTRUC		-
	Survey Coords:		-
	Drilling Summary:	Construction Time Log: Start Finish	KANSAS
٠ ا	Total Depth Borehole Diameter Casing Stick-up Height: Driller Lybro LOGIC INC.	Task Date Time Date Time Drilling 17/367 9.15 12/13 9.45	MARCO ChunUTE, KAN
	Rig < Wen for the form Bit(s) 275" (Fix form) Drilling Fluid	Geophys Logging 745 1 950	.J. I
8	Protective Casing	Filter Placement: 250 900 910 Properties 910 910 930	1 🖺 8
	Basis: Geologic Log Geophysical Log Casing String (s): C = Casing S = Screen. Depth String(s) Elevation	Well Development:	
	Casing C1	Stabilization Test Data: Time pH Spec. Cond. Temp (C) 73	
6	Screen: S1 The Pic 10-Stop S2 Filter Pack: 17-40 GRT SWD 195-30 Grout Seal: FINITE DIE DES. ORT RENTONITE 72-10 Comments: UKISUCKWENTS	Recovery Data: Q= So= 100 R 80 C 60 V 40 R 20 Y 100 TIME ()	SUPERVISED BY M. KELLER
	Sainty Lung (un) a	·0 155	•

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Bo	oring No. X-Re	f: <u>P-</u>	7
MONITOR WELL CONSTRUC	CTION SUMM	ARY	
Survey Coords:			
Drilling Summary:			
		Start	Finish
Total Depth 153 Borehole Diameter 153 Casing Stick-up Height: 237 Driller 150 Hypeologic Inc. Rig 500 From Nobe 700 Bit(s) 500 From Nobe 700 Aug. 67	Drilling	Date Time	
Protective Casing VI STOR Well Design & Specifications	Filter Placement: Cementing: Development:	12 = 10 12 = 10 13,00	-
Basis: Geologic Log Geophysical Log Casing String (s): C = Casing S = Screen. Depth String(s) Elevation	FANTIACE TO SEMBLE STANDARD S	KANIS ANG AKEVENT. YUNGS IT	242'24
Casing: C1			Temp (0 50, 1 50, 5 50, 8
S2	Recovery Data: Q=	S _o =	
Bentonite Seal: INV 111 MGN 3057	C 60 O V 40 R 20 Y 0 20 TIME	40 60	80 .00
Comments:			· · · · · · · · · · · · · · · · · · ·
	MONITOR WELL CONSTRUCT Survey Coords: Drilling Summary: Total Depth	MONITOR WELL CONSTRUCTION SUMM Survey Coords: Elevation Ground L Top of Ca Drilling Summary: Construction T Task Drilling Casing Stick-up Height: 2 1/2 Driller Lybbol/Colc Tac. Rig	MONITOR WELL CONSTRUCTION SUMMARY Survey Coords: Elevation Ground Level Top of Casing Construction Time Log: Start Task Date Time Drilling Summary: Casing Stick-up Height: 2 ½ Order Wybol Cosic Tace. Rig Summary: Geophys Logging Casing: Drilling Fluid Protective Casing Septifications Basis: Geologic Log Geophysical Log Casing String (s): C = Casing S = Screen. Depth String(s) Elevation Casing C1

	7	Well No. P - 9
	Be	Well No. $P - 9$ oring No. X-Ref: $P - 9$
	MONITOR WELL CONSTRUC	
'	Survey Coords:	Elevation Ground Level
-/ - - - - - - - - - - - - -		Top of Casing
	Drilling Summary:	Construction Time Log: Start Finish
- 2	Total Depth 103 Borehole Diameter 111 Casing Stick-up Height: FICA MANATED THE TOTAL MANATED THE TOT	Task Date Time Date Time Drilling Time Time
-3	HydroLOGIC INC. Rig SMCD EARTH PROV 300 Bit(s) 4/1 1012 Rim /3" Flink'S 2.25" Telve Pants	Geophys.Logging Casing:
- 4	Protective Casing FLUSA NOVAT	Filter Placement: 17/10 815 12/10 200 Gementing: 6/71 12/10 15/10 12/10 15/5
	Well Design & Specifications	
-5	Basis: Geologic Log Geophysical Log Casing String (s): C = Casing S = Screen.	Well Development:
	Depth String(s) Elevation 10 2 - 10	TOSING YOURS ELEL
		Stabilization Test Data:
7	Casing: C1 (Page 1976) FVC (Page 1976)	Time pH Spec. Cond. Temp (C) 1942 7.21 1730 46.9 225 7.24 1780 47.2 1957
	Screen: S1 1 The FICE COSE	Recovery Data:
8 1 1 1	Filter Pack: 17 - 27 SAND	Q= S _o =
.0	Grout Seal:	90 E C 60 O V 40
10	Bentonite Seal: Friting . Van _r = Friends . Van _r = 7	7 20 20 40 6C 80 100 TIME ()
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	Company print of company P	
		LINER DENETS 855

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-^	В	oring No. X-Re	f: <u> </u>	-10	
	MONITOR WELL CONSTRUC	TION SUMM	ARY		
' 	Survey Coords:	Elevation Ground Li	evel		
- 21			sing		
	Drilling Summary:	Construction T	ime Log:		
			Start I	1	inish I
/	Total Depth Borehole Diameter	Task Drilling	Date Tir	ne Date	Time
	Casing Stick-up Height:				
	Driller HypeoLOGIC INC.				
		Geophys.Logging Casing:		7.5	1-15
	Rig Site FAR CHAIR SON				
	Drilling Fluid				
	<u> </u>	Filter Placement: Cementing:	<u></u>	,	177
5	Protective Casing from the second sec	Development:	12/11 85	5 2/11	0040
	Well Design & Specifications			_ -	
	Basis: Geologic Log Geophysical Log	Well Developm	ent:	<u></u>	
	Casing String (s): C = Casing S = Screen.	1		/ - ^	
	Depth String(s) Elevation	Prise To	< CMA		· V83
	455 - 1455 - 5	PAPAME TERS	Si dolg -		
		Stabilization Te	st Data:		
		Time pH	Spec. Cond	I. Temp	(C)
	Casing C1	7.04	1.23 815		
14/1.11	C2	7.77	757	57 · 50.	
	Screen: S1 1 2 110 - 5 -	0.39 7.25	740	44.	
1 12		Recovery Data:		1 1 1	-
-052	S2	Q=	S	o =	
	Filter Pack:	•• 100			\neg
		9 sc E C 60			\dashv
	Grout Seal:	O 60 V 40			
	Bentonite Seal: En 6: 10.	E 8 20			
	Deline we deal.	Y			
	32-13	20 TiME	40 6	o 80)	100
	Comments: MExage Ka	9. N. P. 65			
	Commens.				

	7	Well No	o. P	12
-01111	B	Well No oring No. X-Re	f: P-1	2
	MONITOR WELL CONSTRUC			
	Survey Coords:	Elevation Ground Le	evel	
-7팀 템			sing	
	Drilling Summary:	Construction T	ime Log:	
	è		Start	Finish
-4 E E	Total Depth Z2 Sometrial Property Total Depth 7 25	Task Drilling	Date Time 12 /13 0	Date Time 12/11 11/5
	I Casing Stick-up Height:			
	Driller 1) DURVEY HYDROLOGIC INC.			
	Rig SIMCO FACTURELY ZOO	Geophys.Logging Casing:		1 1200
	Bit(s) 2.75 DEINE POLAT			
	Drilling Fluid			
-8 = =	Protective Casing F WSh Mown	Filter Placement: Cementing: Placement	1770	1740
		Development:	1255	310
月月	Well Design & Specifications		<u></u>	<u>\\</u>
	Basis: Geologic Log Geophysical Log Casing String (s): C = Casing S = Screen.	Well Developm	ent:	
('''	Depth String(s) Elevation	Pregio 4	gallons (= 5 Souply.	comy vol)
	211/2 - 11/2 51	FEIR TO	Souphwy.	
	112 - 0			
-17		Stabilization Te	st Data:	
	Casing: C1	Time pH 1255 7.21	Spec. Cond.	(C)
- 10		1306 7.11	3430	51.1
	C2	1306 7.11	3380	52.5
	Screen: S1 1 Th PVC 10-Shot			
- '6 / 🚫 :	S2	Recovery Data: Q=	S _o =	
	Filter Pack: 17-40 WIT CAND	., 100		
	715-93	3 80 E 60 O		
-13 / 12	Grout Seal:			
	2 Constant of the second	¥ 40 E 20		
	Bentonite Seal: FNVV UP VA MED GT.T. GENTINIZ T G2 - 10	l Y		
-70,	92 - 12	20	40 60	80 100
	Comments	1	<u> </u>	
	Comments:	35		
- 7:1				
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	j B _i	oring No. X-Re	f: <u> </u>	14	
	MONITOR WELL CONSTRUC	CTION SUMM	ARY		
	Survey Coords:	Elevation Ground Le	evel		
			sing		
	Drilling Summary:	Construction T	ime Loa:		
	·		Start	Finish	
	Total Depth 25	Task	Date Time		
	Borehole Diameter 7.25 Casing Stick-up Height:	Drilling	17/12 845	12/12 945	อ
三 川	Driller D. Dubney Hyprologic Inc.				کا
7 []	Hydrologic Inc.	Geophys Logging			JARCO
	RIG SIMILO ENCHIPCINE 700	Casing:	945	1 950	
그 [] [Bit(s) 725 DEIVE POINT				. ш
	Drilling Fluid				AM
		Filter Placement:		1000	SITE NAME
	Protective Casing Flush Mount	Cementing: fr.n.	050		- SI
	Well Design & Specifications				
	Basis: Geologic Log Geophysical Log		<u> </u>	<u>'</u> '	
	Casing String (s): C = Casing S = Screen.	Well Developm	ent:		
	Depth , String(s) , Elevation	(FMOVE >	4+ (-1'ONS	1 5 casice Ub')	
	7455 - 1455 51 -	paux to	<u> </u>		
	455 - O CI				
			·		
		Stabilization Te	st Data:		
		Time pH	Spec. Cond.	Temp (C)	
	Casing: C1 1° PVC (ID)	1026 655		53.4	
		6.56	2660 2650	55.0 54.3	i
	C2	6.60	7460	5411	
	Screen: S1 " D Ptc 10-51-1	1031 6.44	7570	544	1
	S2	Recovery Data:			3
1,67	Filter Pack: 12-40 GRIF SOND	Q=	S _o =		M. KELLER
1,6(1)		90 S			K
	Grout Seal:	B 50 E 60 O 60			Z
		0 40			
	Bentonite Seal: 127 - 12	E 20			≿ '
	ENTIRALLY MES. YET DEFINITE	Y , L) (]:
		20	40 60	80 100	VISE
		I	, ,		Supervised by
	Comments: MENSUCEMENTS R	<i>c</i> , <i>c</i>			SUF
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	7	Well No				
		Boring No. X-Ref: P- 16				
	MONITOR WELL CONSTRU	CTION SUMMARY				
	Survey Coords:	Elevation Ground Level				
-: -		Top of Casing				
	Drilling Summary: Construction Time Log: Start Finish					
4	Total Depth 72 7.25 Borehole Diameter 7.25 Casing Stick-up Height: FIXX	Task Date Time Date Time Drilling 17/12 11/50 17/12 1/30				
	Driller HydroLOGIC INC. Rig SIMCO FARTMPORE ZOO Bit(s) 7.25" DCIVE POINT	Geophys Logging Casing:				
8	Protective Casing Futh Mount	Filter Placement: 1300 1315 Cementing: 6-7 3:5 2:50 Development: 1336				
	Well Design & Specifications					
	Basis: Geologic Log Geophysical Log Casing String (s): C = Casing S = Screen.	Well Development:				
	Depth String(s) Elevation					
		Stabilization Test Data:				
	Casing C1 =	Time pH Spec. Cond. Temp (C) 1277 7:43 1750 52.7				
	C2	7:20 :730 53.1				
	Screen: \$1 11 5 (1) 10-5'0"	133- 7.01 17-0 53.0				
	S2	Recovery Data: Q= S _o =				
	Filter Pack: 12-40 ARIT SANS					
	Grout Seal:	R a3 E 65 C 65 C 65 C 40 E 40 E 40 E 60 E 60 E 60 E 60 E 60 E				
20	Bentonite Seal: Enviragly Men. ATT	20 40 60 80 100 TIME ()				
	Comments:	?<->				
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SITE NAME	LOCATION

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IΠ	B∢	Well No oring No. X-Re	f: <u>P-</u>	17
	MONITOR WELL CONSTRUC	CTION SUMM	ARY	
	Survey Coords:	Elevation Ground L	evel	
			sing	
	Drilling Summary:	Construction T	ime Log:	
	218	Table 1	Start	Finish
	Total Depth 21.8 Borehole Diameter (6.2.)	Task Drilling	Date Time	Date Time
	Casing Stick-up Height: Driller UA			-
l	HydroLOGIC INC.			
	Rig to the second of the	Geophys.Logging: Casing:	12 A 1430	
	Rig			
	Drilling Fluid			
	Protective Casing	Filter Placement: Cementing:	430	6
ŀ		Development:	17 19 1415	1014 1035
	Well Design & Specifications			
	Basis: Geologic Log Geophysical Log	Well Developm	ent:	· · · · · · · · · · · · · · · · · · ·
	Casing String (s): C = Casing S = Screen. Depth , String(s) , Elevation	EM W	in the second of the second	945 SELLE 185
l	- 10 68			
l	10:5 - 20:68			
			7	
		Stabilization Te	st Data:	4
		Time pH	Spec. Cand.	Temp (2)
l	Casing: C1	133 6.81	3500_	55 0
ļ	C2	-75 1.43	77.40	en's
	Screen: S1		i	
	S2	Recovery Data:		
	Filter Pack: Z=4 ^	Q=	S _o =	
	70683	9; 100 B 80		
	Grout Seal:	B 80 E 60 O 60		
		V 40		╎ ╏
	Bentonite Seal: Franch: 14 1/63, 28 =	R 20		
	<u> </u>	0 20	40 60	80 100
		TIME	()	
	Comments:			
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	7	Well No	o	19	
	В	oring No. X-Re	f: <u> </u>	19	-
	MONITOR WELL CONSTRUC	CTION SUMM	ARY		,
	Survey Coords:	Elevation Ground L	evel		_
-		Top of Ca	sing		_
	Drilling Summary:	Construction T	_	_	3
-41	Total Depth Z 12	Task	Start Date Time		KANSAS
	Borehole Diameter 7.75 " Casing Stick-up Height: 7.6 (TEMP?)	Drilling	12/11 1455	17/11 1540	AARCO
	Driller HyDROLOGIC INC.	Geophys. Logging			1 2 5:
	Rig SINCO FERTH PRODE TOD Bit(s) 7:35 PRIVE POINT	Casing:	1549	1550	¥ 2
	Drilling Fluid	Filter Placement:	1550	1625	SITE NAME
-3	Well Design & Specifications	Development:	16-10	1640	SIT
_(0	Basis: Geologic Log Geophysical Log Casing String (s): C = Casing S = Screen.	Well Developm	ent:	<u> </u>	
	Depth String(s) Elevation $ \frac{10^{\frac{23}{3}} - 2.2^{\frac{64}{3}}}{2c^{\frac{43}{3}} - 10^{\frac{43}{3}}} = \frac{C1}{51} = -\frac{10}{51} $	FULLY APPL S'GALONS) TO KAMP	FRAM WALL	Vo'vers prior	
12		Stabilization Te	est Data:		
14	Casing: C1		Spec. Cond. 7040 7050 7050 7050	Temp (C) 51.8 51.4	
16	Screen: S1 1" ID AC 10-557	1656 7.43 Recovery Data:	2040	51.9	
	S2	Q=	S _o =		M. KELLER
19	2543- 92 Grout Seal:	R 80 C 60 V 40 E R 20			Σ.κ
20	Bentonite Seal: Enviraging 129: 40 -	0 20	40 60	80 100	SUPERVISED BY_
20	Comments:	<u> </u>			SUPE
54		······································			

APPENDIX G WELL DEVELOPMENT/PURGE DATA SHEETS

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		→
		~

							
	Golder ssociate	W S KDHE/ MAR 973 · 230		ng and l	Recovery	,	Sheet 1 of
Locatio	n	P-2	<u> </u>				
Monitored t	py:	M. KELLEZ	Date:	12/1	2/97] Time:	1820
Well/Piez	zometer Da	ita					
•	•	(circle one) (PVC or ground)		77 3º]fæt	
Radius of ca	sing			- 5	5	inches teet	
Casing Volu	ime				19	cubic feet	
Develop	ment/Pur	ging Discharge D	ata				
Purging met	h∞d			VACUL	JM <)	Men	
Start Purging	3		Date:	17	117/97	Time:	1877
Stop Purging	3		Date:	17/	12] Time:	1837
Monitoring							
Date	Time	Volume discharged	Temp	pH	Spec.Cond.	Turbidity	Appearance of
		(gals)	T	<u> </u>	(mS/cm)	(אזט)	and commen
12112	13773	,5	45.1	17.55	17320	! /	MECY COUTY
	15.7	/	50.1	7.32	17530	!	į

Date	Time	Volume discharged	Temp	pH	Spec.Cond.	Turbidity	Appearance of water
!		(gals)	T		(mS/cm)	(מנמ)	and comments
51151	1323	.5	45.1	7:55	17320		VECY COUTUS-612
		1	50.1	7.32	17530		ι,
	1826	1.5	574	7.23	17580	$I = \overline{I}$	((
		7	53.0	7.15	7510		145. 5. 5. 5.
	770	2.5	たさら	7.02	17:50	Ī	
				1-55	フィラム		
	1831		57.2	1707	3410	/	Ų.
		1					
						/	
						/	
11'- A T	l D	, ,	Z-W-1	K P	2-W-13	ィス	ج ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا ا
water L	evei Keco	very Data					
			_				

S:	ar:	10	ccc	0	cry
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Time:

Monitoring

Date	Clock Time (hh:mm)	Elapsed time (mins)	Water Level (feet) Measurement point:

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Well Purging and Recovery

973-2300.4	Sheet 1 of
P-4	
2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	T'-

Wall	/Piezom	ater '	Data
AA C11	/ F IEZUM	eler .	LJALA.

perp 5/0 = 1.1'.

_	(circle one)
Depth of well (from top of PV	or ground)
Depth to water (from top of PV	Cor ground)

Radius of casing

Location

Monitored by:

Casing Volume

	724 3/C
27.85]fæt
492]fæt
75	inches feet
17.9	cubic feet gallons

Development/Purging Discharge Data

3.7 = 5 casus vol

Purging method	NACUUM SYSTRM			
Start Purging	Date:	2//3	Time:	[//3 8
Stop Purging	Date:	12/13	Time:	11 01

Monitoring

Date	Time	Volume discharged (gals)	Temp (°F)	рН	Spec.Cond. (mS/cm)	Turbidity (NTU)	Appearance of water and comments
1-113	1133	.5	54.8	1.83	1555	<i>j</i>	VERY CHEY. CLEY
	T		59.4	7.50	7660	! /	Į te
!	1	1.5	54.4	7.78	1550		Lt
1	11.371		50,0	- 2	1580	1	1
	1	7.5	59.6	6.501	1600	i i	Mar ermany in in
1		3	54.8	40	1,70	!	` ,
	1	3.15	59.5	6.72	120	1	h
1	1121	Ų	59.2	680	620	i	L-1
j	1.		· · · · ·	1		1 1	
	. 1						

SAMPE PH-W-1 @ 1140

Water Level Recovery Data

Start of recovery

Date: Time:

Monitoring

Date	Clock Time (hh:mm)	Elapsed time (mins)	Water Level (feet) Measurement point
			

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973 - 2300 . 4

Sheet I of ____

Locatio	a	P-6					
Monitored b	py:	M. KELLEZ	Date:	12/	13/97	Time:	315
Well/Piez	ometer Da	ita				.	s'y of -3
		(circle one)				Land	
Depth of we	o qai mori) li:	FPVC or ground)		15 =] (cct	
Depth to wa	qot mori) rat	OF PVC or ground)		13 53		∫f∝t	
Radius of ca	sing			15		inches	
						_] feet	
Casing Volu	ime			7.5	56 56	cubic feet	
					1 = 0.3		
Develop	ment/Pur	rging Discharge D	ata		,	,	
Purging met	hod			リ トミン	UM 5 2	~ F La	
Start Purging	3		Date:	177	112 / 22	Time:	0= 5=
Stop Purging	5		Date:] Time:	0480
Monitoring							
Date	Time	Volume discharged	Temp	ρH	Spec.Cond. (mS/cm)	Turbidity	1 ''
1 2/12	0905	(gais)	I /L/ 4	345	530	NIO	and comments
		• 15	1100	7 F.	1 973	<u>i</u> /	l te
<u></u>	<u> </u>		44.2	4.59		//	<u> </u>
	1920	, 2	44.2	1.61	1 566	//	и
	920	,3	50,2	12.61	1030	,	NATIONAL CONTRACTOR CONTRACTOR
:	920	, 2	49.2	1.61	1 566		и
	920	,3	50,2	12.61	1030		NATIONAL CONTRACTOR CONTRACTOR
	920	,3	50,2	12.61	1030		NATIONAL CONTRACTOR CONTRACTOR
	920	,3	50,2	12.61	1030		NATIONAL CONTRACTOR CONTRACTOR
	920	,3	50,2	12.61	1030		NATIONAL CONTRACTOR CONTRACTOR
	920	, <u>7</u> , <u>7</u> , <u>5</u>	1 50,Z 49,7	661	1030		NATIONAL CONTRACTOR CONTRACTOR
Water L		,3	1 50,Z 49,7	661	1030		NATIONAL CONTRACTOR CONTRACTOR
Water Le	evel Reco	1.2 1.3 1.5 Saufie Ph-	1 50,Z 49,7	661	1030		NATIONAL CONTRACTOR CONTRACTOR
	evel Reco	1.2 1.3 1.5 Saufie Ph-	49.7 49.7	661	966 1030 1050	Time:	NATIONAL CONTRACTOR CONTRACTOR
Start of recov	evel Reco	SAUPE Ph-	19,7 49,7 Wy-1 -	7.61 2.25	1950 1950	Time:	Water Level (feet)
Start of recov	evel Reco	SAUPE Ph-	19,7 19,7 Date: Clock Time	Elapsed	1950 1950	Time:	Water Level (feet)
Start of recov	evel Reco	SAUPE Ph-	19,7 19,7 Date: Clock Time	Elapsed	1950 1950	Time:	Water Level (feet)
Start of recov	evel Reco	SAUPE Ph-	19,7 19,7 Date: Clock Time	Elapsed	1950 1950	Time:	Water Level (feet)
Start of recov	evel Reco	SAUPE Ph-	19,7 19,7 Date: Clock Time	Elapsed	1950 1950	Time:	Water Level (feet)
Start of recov	evel Reco	SAUPE Ph-	19,7 19,7 Date: Clock Time	Elapsed	1950 1950	Time:	Water Level (feet)
Start of recov	evel Reco	SAUPE Ph-	19,7 19,7 Date: Clock Time	Elapsed	1950 1950	Time:	Water Level (feet)
Start of recov	evel Reco	SAUPE Ph-	19,7 19,7 Date: Clock Time	Elapsed	1950 1950	Time:	Water Level (feet)
Start of recov	evel Reco	SAUPE Ph-	19,7 19,7 Date: Clock Time	Elapsed	1950 1950	Time:	Water Level (feet)

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		W S KDHE/ MAR 973-230					Sheet 1 of
Locatio	מכ	[-7-					
Monitored	by:	M. KELLEZ	Date:	12/	0/97	Time: [1050
Well/Pic	zometer Da	ita		·			
5	11 / 20	(circle one)			· · · · · · · · · · · · · · · · · · ·	٦.	
•	-	(PVC or ground)		15] feet	8
Depth to w	ater (from top o	of PVC or ground)		7	<u>-</u>]fæt 🦿	r 28
Radius of o	esing			.5		inches	
				L		∫feet -	
Casing Vol	ume			7.1		cubic feet	
					74	gallons	
Develop	oment/Pur	ging Discharge D	ata	TI WIT	De AA'	ANDJACK	THIS POURTE IN
Purging me	thod			TIVE	UL'M SY	KTEM	
Start Purgir	ng		Date:	1,1	/ つ] Time: [1: 23
			Date:	10	17	٦ ٦	
Stop Purgir	g		Date.	<u> </u>] Time: [1520
Stop Purgir Monitorin			Date.		<u> </u>] Ime: [1520
		Volume discharged	Temp	pH	Spec.Cond.	Turbidity	Appearance of water
Monitorin Date	Time	(gals)					
Conitoring	K		Temp		Spec.Cond. (mS/cm)	Turbidity	Appearance of water
fonitorin Date	Time	(gals)	Temp (F)	pH	Spec.Cond.	Turbidity	Appearance of water
Conitoring	Time /3 > V	(gals) 1~17AL .5 /	Temp (°F)	pH	Spec.Cond. (mS/em)	Turbidity	Appearance of water and comments
Monitorin	Time /3 > 0	(gals) 1~17AL .5 / 1.5 Z	Temp (°F)	рН ЛД 7,36 37	Spec.Cond. (mS/cm)	Turbidity (NTU) /	Appearance of water and comments
fonitorin Date	Time /3 > 0	(gals) 1~17AL .5 1 1.5 2 2.5	Temp (°F)	pH	Spec.Cond. (mS/em) 3 0 140 0 131 0 134 0 134 0	Turbidity (NTU) /	Appearance of water and comments
fonitorin Date	Time /3 > 0	(gals) 1~17AL .5 / 1.5 Z	Temp (F)	рН ЛД 7,36 37	Spec.Cond. (mS/cm)	Turbidity (NTU)	Appearance of water and comments
fonitorin Date	Time /3 > 0	(gals) 1~17AL .5 1 1.5 2 2.5	Temp (°F)	pH	Spec.Cond. (mS/em) 3 0 140 0 131 0 134 0 134 0	Turbidity (NTU) /	Appearance of water and comments
fonitorin Date	Time /3 > 0	(gals) 1~17AL .5 1 1.5 2 2.5	Temp (°F)	pH	Spec.Cond. (mS/em) 3 0 140 0 131 0 134 0 134 0	Turbidity (NTU)	Appearance of water and comments
fonitorin Date	Time /3 > 0	(gals) 1~17AL .5 1 1.5 2 2.5	Temp (°F)	pH	Spec.Cond. (mS/em) 3 0 140 0 131 0 134 0 134 0	Turbidity (NTU)	Appearance of water and comments
Conitoring Date 12 /16	Time /500 1510 1513 1517 1500	(gals) 1~1maL .5 1 1.5 2 2.5 2.7	Temp (°F)	pH	Spec.Cond. (mS/cm) 350 1470 1310 1340 1340	Turbidity (NTU)	Appearance of water and comments
Monitoring Date	Time	(gals) 1 N 1 M A L . 5 . 1 . 1 . 5 . 2 . 2 . 5 . 2 . 2	Temp (F)	pH	Spec.Cond. (mS/cm) 350 1470 1310 1340 1340	Turbidity (NTU)	Appearance of water and comments

Date	Clock Time	Elapsed time	Water Level (feet)
	(hh:mm)	(mins)	Measurement point
		 	
			
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Well Purging and Recovery KDHE/ MARCO C.I/KS Sheet 1 of ____ 973 -2300 . 4 Location Date: Monitored by: M. KELLEZ Well/Piezometer Data ionf ... 1 - 3 (circle one) Depth of well (from top of PVC or ground) feet feet Depth to water (from top of PVC or ground) Radius of casing inches feet Casing Volume cubic feet gallons Development/Purging Discharge Data TACOUM Purging method SYSTEM Start Purging Date: Time: 521 Date: Time: 1555 Stop Purging Monitoring Volume discharged Temp pΗ Spec.Cond. Turbidity Date Time Appearance of water (mS/cm)(stag) (NTU) and comments 1.710 1545 1547 189-W-1) WELL SAMPLE 1550 Water Level Recovery Data Date: Time: Start of recovery Clock Time Date Elapsed time Water Level (feet) Monitoring (hh:mm) Measurement point (mins)

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***	SOCIAL	,		/ ~>			Sheet 1 of
Locatio	n	973·230		15h Gr.	VE Pre	100 E J	
							
Monitored b	y:	M. KELLEZ	Date:	12/	11/97	Time:	250
Well/Piez	ometer Da	ata					
Depth of we	ell (from top o	(circle one) [PVC or ground]		,	5 %] [cct	TEAP 5/4 = 1.1
Depth to wa	ter (from top	of PVC or ground)			1 4	_][cct	
Radius of ca					5	linches	
	J] feet	
Casing Volu	me				<u>51</u> .51	cubic feet	
Develop	ment/Pur	rging Discharge D	ata				
Purging met	hod			JAC	CUM SY	STEM	
Start Purging			Date:	12/1		Time:	0414
Stop Purging			Date:	12/	71	Time:	0939
0 <u></u>			24				
Monitoring							
Date	Time	Volume discharged	Temp	PH	Spec.Cond.	Turbidity	1 ''
	0000	(gals)	TO TO	17.05	(mS/cm)	עוט	and comments
12/11	0920	- 5 - 5		17:05	801	 	yrey condy
	0923	, 3	57.5	7.09	1 823	:	
	!	 	50.9			!	1
	 	1.5	49.4	7.27			1 2 2 2
		2		17.31	1740		
	17739	2.5	1 49.7	17.75	748		
		<u> </u>	<u> </u>	 		<u> </u>	<u> </u>
			<u> </u>	<u> </u>	<u> </u>	<u>: / </u>	
	-	<u> </u>	<u> </u>	1	<u> </u>	1 /	
			<u> </u>		i		
		very Data	_	g <aup!< th=""><th>E P10-</th><th></th><th>TREEN @ 3942</th></aup!<>	E P10-		TREEN @ 3942
Start of recov	ery		Date:	·		Time:	
Monitoring		Date	Clock Time (hh:mm)	Elapsed (m.		Measureme	Water Level (feet) nt point
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	L		<u></u>				
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	Golder ssociat	W ES KDHE/MAR	ell Purgir	ng and I	Recovery	,	
_		973 - 230					Sheet I of
Locatio	n	P-12					
Monitored t	рут	M. KELLEZ	Date:	12/	11/97	Time:	1745
Well/Piez	ometer D	ata					TMP 5/0,66'
Depth of we	:ll (Crom top c	(circle one)		21.16	-]feet	TAP STO
Depth to wa	ter (from top	of PVC or ground)		マリ] feet	
Radius of ca	sing .			15		inches	
Casing Volu	ime			70		cubic feet	
Develop	ment/Pu	rging Discharge D	ata				
Purging met	hod			VAC	oum Sy	151 000	
Start Purging	3		Date:	12/	/11	Time:	1255
Stop Purging	3		Date:	12	14] Time:	1310
Monitoring							
Date	Time	Volume discharged (gals)	Temp (F)	pН	Spec.Cond. (mS/cm)	Turbidity (NTU)	Appearance of water and comments
12/11	1757	INITIAL	51.6	7.30	787 O		Viey chow by - wey
			50.5	7.21			'/
	1302	7	52.1	7.13	13430		b b
	1310	1	67.5	17.10	1-270		Moderately Cloudy-Ge
	1	 7		 /:\	1	i 	
·		<u> </u>		ļ		<u> </u>	
	<u> </u>						
		cample ?	> P12 -	W-1	(P)	3/0	
Water L	evel Reco	overy Data					
Sun of recov	ету		Date:			Time: [
Monitoring		Date	Clock Time (hh:mm)	Elapsed (mi	ŀ	Measureme	Water Level (feet) nt point
							
							
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S A	Golder ssociate	es kohe/mar		ng and I /KS	Recovery	•	Sheet 1 of
		973 - 230	0.4				
Locatio	a	P-14 GER	KE SU	AP MED	<u>.</u>		
Monitored	by:	M. KELLER	Date:	12/1	2/97] Time:	[070]
Well/Pie	zometer Da	ıta					
		(circle one)					
Depth of w	ell (from top o	fPVC of ground)		750		feet	
Depth to w	ater (from top	of PVC or ground)		45](cct	
Radius of c	asing	<u></u>		5		linches	
	•					feet	
Casing Vol	ume			20.0	<u> </u>	cubic feet	
•				٤ .	2	gallons	
Develop	oment/Pur	rging Discharge D	ata				
Purging me	thod			VACU	um. 54	STEUA	
Start Purgin	ng		Date:	12/	12	Time:	1070
Stop Purgin			Date:	12/1	2	Time:	1031
				<u></u>		,	
Monitoring	3						
Date	Time	Volume discharged	Temp	рН	Spec.Cond.	Turbidity	Appearance of water
	<u> </u>	· (gals)	T	 	(mS/cm)	(מנמ)	and comments
12/12	1053	15	1 115.9	1 (0.33	7070		Wey Clossy-Beaux
	 	<u> </u>	1 57.8	19.45	7750		ч
	1 1026	1.5	53.4	6.50	7790		!
	1 9	2	55.0	6.54	2660		<u> </u>
	1 1028	3.5	154.4		7650		Muldute Ly
	 	3.5		3.60		_{-	
	1031	 	54.4	6.64	2670	/ -	М
	!		 		<u> </u>	-/	
	 		<u> </u>		·	+	<u> </u>
	L	<u> </u>	I	!!		/	<u> </u>
		SOMP'E WEL	I Diel	1-w-1	e ciu.	1-17	D 1775
	. ~		· - F19		a 1 3.00	· 1 ·	
Water L	evel Reco.	very Data					
Start of reco			Date			 1	
SOUT OF FECO	vety		Date:	1	1	Time:	

Start of	î recovery
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Monitoring	

	D8.5.		Tune.
Date	Clock Time (hh:mm)	Elapsed time (mins)	Water Level (feet) Measurement point

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S A	sociate	25 KDHE/MAR 973.230		'KS			Sheet 1 of
Location	n	P-16	<u> </u>				
Monitored b		M. KELLEZ	Date:	[12/	12/97	Time:	[]3 5
	ometer Da		_			_	
		(circle one)					
Depth of we	ll (from top o	fPVC or ground)		20-	,] feet	
Depth to wa	ter (from top	of PVC or ground)		- 50		feet	
Radius of ca	sing			,=		inches	
						feet	
Casing Volu	me			14,		cubic feet	
				78	<u> </u>	gallons	
Develop	ment/Pur	rging Discharge D	ata				
Purging met	hod			Vicy	υμ <u>ξ</u> γ.	ças)a	
Start Purging	5		Date:	12/	2107	Time:	378
Stop Purging			Date:	7	<u>'</u>	Time:	1330
	•			<u> </u>			<u> </u>
Monitoring							
Date	Time	Volume discharged	Temp	pН	Spec.Cond.	1	Appearance of water
12/17	1373	(elag) 5.	50·8	7.86	(mS/cm)	ן (אזט)	UES Chron - Penny
			57.7	7.43	1750	! /	
	1327	15	57.6	7.30	1720	! /	1
	!	Z	52.0	7.27	11730	- / /	<u> </u>
	1334	3	53.1	7.70	1740	· / /	MATERIA
	1326	<u> </u>	1 - 2 3	1.61		: / 	· · · · · · · · · · · · · · · · · · ·
				 		 	
	· ·			1	<u> </u>	1 / 1	
						1////	
Water L	evel Reco	≤ky'€⊃ overy Data	tip-m-	1 2	1336	,	
Sun of recov	ery		Date:	<u> </u>		Time:	
Monitoring	·	Date	Clock Time	Elapsed	l time	-	Water Level (feet)
			(խի։ռոտ)	,	ins)	Measuremen	
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KDHE/ MARCO C.I/KS Sheet 1 of 973.2300.4 Location =: . . ! Monitored by: M. KELLER Time: Dez: Weil/Piezometer Data (circle one) Depth of well (from top of PVC or ground) feet Depth to water (from top of PVC or ground) [œt Radius of casing inches feet cubic feet Casing Volume gailons Development/Purging Discharge Data 🚄 Purging method /CUUM SYSTEM Start Purging Date: Time: 1635 Step Purging Date: Time: Monitoring Volume discharged ρH Spec.Cond. | Turbidity Date Time Temp Appearance of water (mS/cm) (NTU). (eleg) and comments Water Level Recovery Data Start of recovery Date: Ting. Clock Time Elapsed, time Water Level (feet) Date Monitoring (hh:mm) (mins) Measurement point:

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14	Golder
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Well Purging and Recovery
KDHE/ MARCO C.I/KS

Sheet	I	of		
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		973.2300	o • 4				_
Locatio	n	P-19					
Monitored 1	by:	M. KELLEZ	Date:	12/	11/97	Time:	1535
Well/Pie	zometer Da	ata					,
Depth of we	o qos mori) lis	(circle one)			0.93	∫íœt	TRUP 5/0 7.6
Depth to wa	iter (from top	of PVC or ground			<u></u>	_ [cct	
Radius of ca					,5	inches	
	Ū					lect	
Casing Volu	ıme				4.33	cubic feet	
.	400	· · · · · · · · · · · · · · · · · · ·			 		
Develop	ment/Pu	rging Discharge Da	ita			_	
Purging met	hod			Ung	CVVM SY	15-12/1	
Start Purgin	g		Date:	12/	11197	Time:	140
Stop Purging	3		Date:	[7]	<i>†11</i>	Time:	1656
Monitoring	:						
Date	Time	Volume discharged	Temp	pH	Spec.Cond.	Turbidity	Appearance of water
		(gals)	<u></u>	<u> </u>	(mS/cm)	מזא	and comments
12/11	 			 	 	-	VERY CLOUDY - BEUWI
	11645	.5	51.7	7.80	17040	; /	i ii
		2	51.8	7.73	15060	1	4
	<u>!</u>	2.5	51.9 52.3	7.44	12040	 	Mos. 1. 1.
	456	4	519	7.43	12040	 	• (
_			· · · · · · · · · · · · · · · · · · ·				
	<u> -</u>			 	<u> </u>	! 	
	!	S (L	iple f	1	-1 TAI	1. N (1)	1656
		overy Data			·	<u>, </u>	
Start of recov	rery	A.—	Date:			Time:	
Monitoring		Date	Clock Time (hh:mm)	Elapsed (m	d time ins)	Measuremen	Water Level (feet) nt point
							
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Monitored	b y.	M. KELLEZ	Date:	12/	13/97	Time:	1433
Well/Pie	zometer D	ata		STIC	k up 1.71	,	
		(circle one)				_	
		fPVC or ground)			۲ <u>. ۲</u> ۱	_]fæt	
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Radius of c	esing				1	inches feet	
Casing Vol	ume			21.	75 48	cubic feet	
Develop	ment/Pu	rging Discharge D	ata	10	noling 4.	punge	
Purging me	thod			EFET	ec pum	P	
Start Purgin	g		Date:	17/1	3	Time:	1933
Stop Purgin	g		Date:	12/1	3	Time:	
Monitoring	5						
Date	Time	Volume discharged	Temp	pН	Spec.Cond.	Turbidity	Appearance of water
	1	(gala)	T	1	(mS/cm)	ן מזט	and comments
12/13	11933	2 4	1765	1.10	1620	! 	Slight & Cloudy
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Monitoring		Date	Clock Time (hh:mm)	Elapsed (mi		Measureme	Water Level (feet)

Date	Clock Time (hh:mm)	Elapsed time (mins)	Water Level (feet) Measurement point
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Well Purging and Recovery
KDHE/MARCO C.I/KS

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Sheet	1	10	

		973 -230	2.4			Sheet 1 of
Location	n	M3	<u> </u>			
Monitored b		M. KELLEZ	Date:	12/	12/97 Time:	
				,	. – •	<u> </u>
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Depth to wa	ret (nour pb (fPVC or ground)		3:	[cet	
Radius of ca	sing				inches	
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Purging met	hod			6 40	FAIC PURA	
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Start of recov	ery _		Date:		Time:	<u> </u>
Monitoring		Date	Clock Time (hh:mm)	Elapsed (mi		Water Level (feet) ent point
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Golder	
Associates	

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		973 -230	0.4				
Location	מ	11-4			 		
Monitored b	λ:	M. KELLEZ	Date:	12/	13/97] Time:	
Well/Piez	ometer Da	ata	•	55 " K - 1 10	20		
Depth of we	ll (from top ó	(circle one) IPVC or ground)		[]7	.6	feet	g error
	_	of PVC or ground)			75]fœt	936,64 E'EV.
Radius of ca	'					inches feet	
Casing Volu	me				.75	cubic feet	
Develop	ment/Pu	rging Discharge D	ata	5.9 0	et Nolls	tal P	ne ve
Purging med	nod			FLACT	vic p	unp	
Start Purging	:		Date:	TE /13] Time:	
Stop Purging			Date:	12/13] Time:	
Monitoring							
Date	Time	Volume discharged (gals)	Temp (F)	pH	Spec.Cond. (mS/cm)	Turbidity (NTU)	Appearance of water and comments
12/13	5:00		C/1.0	765			RUSTY
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	5:40	6	50.3	(578)	-7.39O		CESS CLOUDY
		 		 			<u> </u>
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Water Le	evel Reco	overy Data	We	W >	cample)) <u>174</u>	5
Start of recove	сту		Date:			Time:	
Monitoring		Date	Clock Time (hh:mm)	Elapsed (mi		Measureme	Water Level (feet)
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APPENDIX H HLI ANALYTICAL RESULTS



1927 N. 1275 Road

Eudora, Kansas 55025-8127

Office (913) 542-2518

Fax. (913) 542-3971

December 19, 1997

RECEIVED

DEC 26 1997

ates, Inc. GOLDER ASSOCIATES

Golder Associates, Inc. Attn: Mike Keller 200 Union Blvd. Suite 500 Lakewood, CO 80228

97-66-118

RE: Final Analytical Report for the Former MARCO Refinery in Chanute, Kansas.

Mr. Keller,

Hydro-LOGIC, Inc. (HLI) is pleased to submit the analytical results for the above referenced site. A total of 19 soil samples and 23 groundwater samples were analyzed for purgeable chlorinated hydrocarbons and aromatic hydrocarbons, by USEPA method 8021, and for total petroleum hydrocarbons, by method OA-2. Additionally four (4) duplicates and two (2) drum water samples were also analyzed. Analytical results for all samples follow on the enclosed laboratory data sheets.

HLI appreciates this opportunity to provide our environmental services. Should you have any questions or require additional information, please call myself or Don Dulaney at (785) 542-2518.

Sincerely,

Hydro-LOGIC, Inc.

Peter Guy

Environmental Scientist/Chemist

Attachments

Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P10-S-1 7.5′ 12/9/97

Date Sampled: 12/9/97 Date Analyzed: 12/9/97 Sample: 1 of 48 Method: EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 5.0	5.0 µg/kg ⁰
Chloromethane	< 5.0	5 Ο μ ακ α
Vinyl chloride	< 5.0	50 pgkg
Bromomethane	< 5.0	5 0 µg%g
Chloroethane	< 50	5 0 µg%g
Trichlorofluoromethane	< 5.0	5.0 ng/kg
1,1-Dichloroethene	< 5.0	5-0 µgAg
Methylene chloride	< 50	5 0 µgkg
trans-1,2-Dichloroethene	< 5.0	5.0 µg/kg
1,1-Dichloroethane	< 50	50 mg kg
Chloroform	< 50	5.0 µg kg
1,1,1-Trichloroethane	< 50	5 0 ng kg
Carbon tetrachloride	< 5 ()	50 ngkg
1,2-Dichloroethane	< 50	50 ng kg
Trichloroethene (TCE)	< 50	5 0 µg%g
1,2-Dichloropropane	< 50	5.0 ngkg
Bromodichloromethane	< 5.0	5.0 µg%g
cis-1,3-Dichloropropene	< 50	5 0 pg kg
trans-1,3-Dichloropropene	< 5.0	5 O ng kg
1,1,2-Trichloroethane	< 50	5 O jig kg
Tetrachloroethene (PCE)	< 50	5.0 µg/kg
Dibromochloromethane	< 50	5 O µgAg
Chlorobenzene	< 50	5 O ng kg
Bromotorm	< 50	5 0 ng%g
1,1,2,2-Tetrachforoethane	< 50	5 Cag kg
1,3-Dichlorobenzene	< 50	5 O ng kg
1,4-Dichlorobenzene	< 50	50 ng/kg
1,2-Dichlorobenzene	< 50	5 O ngkg

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1. μg/kg Micrograms per kilogram (parts per billion).

Signed Janving
Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample 1D: Date Sampled: 12/9/97

P10-S-1 7.5'

Date Analyzed: 12/9/97

Sample: 1 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 μg/kg	· · · · · · · · · · · · · · · · · · ·
Toluene	< 10.0	10.0 µg/kg	-
Ethylbenzene	< 10.0	10.0 μg/kg	-
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	11
Naphthalene	< 10.0	10.0 μg/kg	<u>-</u>
TPH (DRO)	< 1.00	1.00 mg/kg ²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

Signed FanGuy Peter T. Guy

Analyst

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P18-S-1 3.0'

Date Sampled: Date Analyzed: 12/9/97 12/9/97 Sample: 2 of 48 Method: EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichloroditluoromethane	< 50	TO ug kg'
Chloromethane	< 5 ()	50 ng kg
Vinyl chloride	< 5.0	5 O ng kg
Bromomethane	< 5.0	50 ng/kg
Chloroethane	< 5.0	50 ng kg
Trichlorofluoromethane	< 5.0	5 O ngAg
1,1-Dichlorcethene	< 5.0	50 ugkg
Methylene chloride	< 5.0	5 0 µgkg
trans-1,2-Dichloroethene	< 50	50 ngkg
1,1-Dichlorcethane	< 50	5 0 ng kg
Chloroform	< 5.0	5 0 µg.kg
1,1,1-Trichloroethane	< 5.0	5 Capag
Carbon tetrachloride	< 5.0	5 trug kg
1,2-Dichloroethane	< 5.0	5 O ng kg
Trichloroethene (TCE)	< 5 ()	5 0 µg kg
1,2-Dichloropropane	< 5.0	5 0 µg kg
Bromodichloromethane	< 5.0	5.0 ag\$g
cis-1,3-Dichloropropene	< 50	5 0 ng kg
trans-1,3-Dichloropropene	< 5 ()	7 () ад к д
1,1,2-Trichloroethane	< 50	5 Cag kg
Tetrachloroethene (PCE)	< 50	5 0 ng kg
Dibromochloromethane	< 5.0	50 ng kg
Chlorobenzene	< 5.0	5 () µg%g
Bromoform	< 5.0	5 0 pg/kg
1,1,2,2-Tetrachioroethane	< 5.0	5 0 ₆₀₃ kg
1,3-Dichlorobenzene	< 5.0	7 O ang kg
1,4-Dichlorobenzene	< 50	50 ngkg
1,2-Dichlorobenzene	< 5 ()	5 O ag kg

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1. μg/kg Micrograms per kilogram (parts per billion).

Signed John Sun Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: 12/9/97

P18-S-1 3.0'

Date Analyzed: 12/9/97

Sample: 2 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg'	-
Benzene	< 10.0	10.0 μg/kg	-
Toluene	< 10.0	10.0 μg/kg	-
Ethylbenzene	< 10.0	10.0 μg/kg	-
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	1
Naphthalene	< 10.0	10.0 μg/kg	-
TPH (DRO)	< 1.00	1.00 mg/kg²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

Analyst

Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P18
Date Sampled: 12/9/97
Date Analyzed: 12/9/97

Sample: 3 of 48 Method: EPA 8021 Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 10	1.0 ng F
Chloromethane	< 1.0	1 () pg1
Vinyl chloride	< 10	10.12
Bromomethane	< 1.0	1 0 µgT
Chloroethane	< 1.0	1 0 µg.l
Trichlorofluoromethane	< 1.0	1 θ μgΤ
1,1-Dichloroethene	< 1.0	1 O µg/1
Methylene chloride	< 1.0	Pgn 0 1
trans-1,2-Dichloroethene	< 1.0	1 θ μg/Ι
1,1-Dichloroethane	< 1.0	1 0 ag1
Chloroform	< 1.0	10.001
1,1,1-Trichloroethane	< 10	1 0 ng l
Carbon tetrachloride	< 1.0	" C ng"
1,2-Dichloroethane	< 10	Pg.a 0 1
Trichloroethene (TCE)	< 1.0	10 g i
1,2-Dichloropropane	< 1.0	Fg.4 0 7
Bromodichloromethane	< 1.0	1.0 µg.1
cis-1,3-Dichloropropene	< 10	1.0.493
trans-1,3-Dichloropropene	< 10	1.0
1,1,2-Trichloroethane	< 1 ()	1.0 ng l
Tetrachloroethene (PCE)	< 1.0	1 0 ng/1
Dibromochloromethane	< 1.0	2.0 ag.1
Chlorobenzene	< 10	1 0 ngT
Bromotorm	< 1.0	1 O ngT
1,1,2,2-Tetrachloroethane	< 1 ()	1.00.00,
1,3-Dichlorobenzene	< 10	2.34.43
1,4-Dichlorobenzene	< 1.0	Salag I
1,2-Dichlorobenzene	< 10	1 0 pg/1

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1. μg/l Micrograms per liter (parts per billion).

Signed Trus Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample 1D:

Method: EPA 8021/OA-2 Matrix: Water

Sample: 3 of 48

Date Sampled: 12/9/97

Date Jampieu.	213131	VIGUAL AVE
Date Analyzed: 1	2/9/97	

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	-
Benzene	< 2.00	2.00 µg/l	<u>-</u>
Toluene	< 2.00	2.00 μg/l	<u>-</u>
Ethylbenzene	< 2.00	2.00 μg/l	<u>-</u>
Xylenes (o,m,p)	< 6.00	6.00 µg/l	1
Naphthalene	< 2.00	2.00 μg/l	
TPH (DRO)	< 0.50	0.50 mg/l²	<u>-</u>

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

 μ g/l Micrograms per liter (parts per billion).

Milligrams per liter (parts per million). mg/l

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: **P9-S-1 1.5′** 12/10/97

Date Analyzed: 12/10/97

Sample: 4 of 48 Method: EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 50	5 O gg kg'
Chloromethane	< 5.0	5 Ougkg
Vinyl chloride	< 5.0	5 Ongika
Bromomethane	< 5.0	5.0 ng%g
Chloroethane	< 5.0	5 Cugkg
Trichlorofluoromethane	< 5.0	5 C ugkg
1,1-Dichloroethene	< 50	5-0 µqkg
Methylene chloride	< 5.0	5 () μ g kg
trans-1,2-Dichloroethene	< 50	5.0 ng kg
1,1-Dichloroethane	< 50	5.0 , eg kg
Chloroform	< 5.0	5 O µg%g
1,1,1-Trichtoroethane	< 5.0	5.0 ag kg
Carbon tetrachloride	< 50	7 () ,, & Kg
1,2-Dichloroethane	< 50	5 Dagkg
Trichloroethene (TCE)	< 5.0	5 0 ng kg
1,2-Dichloropropane	< 50	5 0 µg%g
Bromodichloromethane	< 5.0	5 Cugkg
cis-1,3-Dichloropropene	< 5.0	$^{-}$ 0 $_{x}$ g λ g
trans-1,3-Dichloropropene	< 5.0	5 0 tog kg
1,1,2-Trichloroethane	< 50	5.0 ag kg
Tetrachloroethene (PCE)	< 5.0	5 (eng kg
Dibromochloromethane	< 5.0	5 0 ng kg
Chlorobenzene	< 50	5 0 ngAg
Bromotorm	< 5.0	5 O ng kg
1,1,2,2-Tetrachloroethane	< 5.0	5 Cang kg
1,3-Dichlorobenzene	< 5.0	5-0-463 kg
1,4-Dichlorobenzene	< 50	5 cong kg
1,2-Dichlorobenzene	< 5.0	5% wasky

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1.	μg/kg	Micrograms p	oer kilogram	(parts per	billion)
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Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

Date Analyzed: 12/10/97

P9-S-1 1.5' Date Sampled: 12/10/97

Sample: 4 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 μg/kg	<u>-</u>
Toluene	< 10.0	10.0 µg/kg	<u>-</u>
Ethylbenzene	< 10.0	10.0 μg/kg	<u>-</u>
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	1
Naphthalene	< 10.0	10.0 μg/kg	<u>-</u>
TPH (DRO)	< 1.00	1.00 mg/kg²	<u>. </u>

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

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Client/Site: Golder Assoc./MARCO Refinery

 Sample ID:
 P8-S-1 2.0'

 Date Sampled:
 12/10/97

 Date Analyzed:
 12/10/97

Sample: 5 of 48 Method: EPA 8021 Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 50	5 O µg kg"
Chloromethane	< 5.0	5.0 ng kg
Vinyl chloride	< 50	5 C pg/kg
Bromomethane	< 5.0	70 ng kg
Chloroethane	< 5.0	7.0 agAg
Trichlorofluoromethane	< 5.0	50 ng kg
1,1-Dichloroethene	< 5.0	5 () ng kg
Methylene chloride	< 50	5 0 µg kg
trans-1,2-Dichloroethene	< 50	Sungkg
1,1-Dichloroethane	< 5.0	5 O pig kg
Chloroform	< 5.0	5.0 ng kg
1,1,1-Trichloroethane	< 5.0	Stopling
Carbon tetrachloride	< 50	5 Canokg
1,2-Dichloroethane	< 50	50 mg kg
Trichloroethene (TCE)	< 5.0	5.0 µg.kg
1,2-Dichloropropane	< 5.0	50 ngkg
Bromodichloromethane	< 50	5.0 mg kg
cis-1,3-Dichloropropene	< 5.0	TO an kee
trans-1,3-Dichloropropene	< 5.0	7 Cag kg
1,1,2-Trichloroethane	< 50	5 () 4.g kg
Tetrachloroethene (PCE)	< 5.0	50 ngkg
Dibromochloromethane	< 50	5 0 дд кg
Chlorobenzene	< 50	50 ag kg
Bromoform	< 50	2.0 t/kg/yk
1,1,2,2-Tetrachforoethane	< 5 ()	7 (* 1, g × g
1,3-Dichlorobenzene	< 5 ()	S Good Kg
1,4-Dichlorobenzene	< 50	5 O ng kg
1,2-Dichlorobenzene	< 50	5 Oug kg

Units:

1. μg/kg Micrograms per kilogram (parts per billion).

Signed Analyst - Peter Guy

HV310-L 0 G 1 C

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: 12/10/97

P8-S-1 2.0'

Date Analyzed: 12/10/97

Sample: 5 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 μg/kg	-
Toluene	< 10.0	10.0 μg/kg	<u>-</u>
Ethylbenzene	< 10.0	10.0 μg/kg	<u>-</u>
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	1
Naphthalene	< 10.0	10.0 μg/kg	-
TPH (DRO)	< 1.00	1.00 mg/kg²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P8
Date Sampled: 12/10/97
Date Analyzed: 12/10/97

Sample: 6 of 48 Method: EPA 8021 Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorod:fluoromethane	< 10	LungT
Chloromethane	< 10	1.0 .03.1
Vinyl chloride	< 1.0	1.0 μg/1
Bromomethane	< 10	1 0 pgT
Chloroethane	< 1.0	1 (0 p.g.)
Trichlorofluoromethane	< 1.0	1.0 4.67
1,1-Dichloroethene	< 1.0	1 0 ag/l
Methylene chloride	< 1.0	: 0403
trans-1, 2-Dichioroethene	< 10	7 O 4.gT
1,1-Dichloroethane	< 10	· O
Chlorotorm	< 10	* () tog (
1,1,1-Trichloroethane	< 1.0	* 0 mg t
Carbon tetrachloride	< 10	*10.59
1,2-Dichloroethane	< 1.0	1 ()(g')
Trichloroethene (TCE)	< 10	Fgn O f
1,2-Dichloropropane	< 1.0	1 O jug i
Bromodichloromethane	< 10	1.0 .ng.1
cis-1,3-Dichloropropene	< 1.0	1.0 ag l
trans-1,3-Dichloropropene	< 10	1.0 μα/1
1,1,2-Trichloroethane	< 10	t (t e.g. i
Tetrachloroethene (PCE)	< 10	1 () (.g.)
Dibromochloromethane	< 10	to ag!
Chlorobenzene	< 1 ()	* Charl
Bromotorm	< 1 ()	1.0 ((1))
1,1,2,2-Tetrachloroethane	< 10	10,0
1,3-Dichlorobenzene	< 10	! ee.!
1,4-Dichlorobenzene	< 10	10g1
1,2-Dichlorobenzene	< 1.0	10.93

Units:

1.	μg/l	Micrograms	per li	iter (parts	per	billion).
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Signed Identify
Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

Sample: 6 of 48 Method: EPA 8021/OA-2

Date Sampled: 12/10/97 Date Analyzed: 12/10/97 Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	•
Benzene	< 2.00	2.00 µg/l	-
Toluene	< 2.00	ا/يور 2.00	<u>-</u>
Ethylbenzene	< 2.00	2.00 µg/l	-
Xylenes (o,m,p)	< 6.00	6.00 µg/l	1
Naphthalene	< 2.00	2.00 μg/l	<u>-</u>
TPH (DRO)	< 0.50	0.50 mg/l²	<u>-</u>

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

μg/l Micrograms per liter (parts per billion).

Milligrams per liter (parts per million). mg/l

Signed John Peter T. Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P7-S-1 1.5′ 12/10/97

Date Sampled: Date Analyzed:

12/10/97

Sample: 7 of 48 Method: EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 50	5.0 µg/kg"
Chloromethane	< 50	5.0 pg.kg
Vinyl chloride	< 5.0	5 0 ng kg
Bromomethane	< 5.0	5 O p.g.kg
Chloroethane	< 50	7 Cing kg
Trichlorofluoromethane	< 50	5 0 µg kg
1,1-Dichloroethene	< 5.0	5 O ngkg
Methylene chloride	< 50	5 0 µgkg
trans-1,2-Dichloroethene	< 50	5.0 ng kg
1,1-Dichloroethane	< 50	5.0 ag kg
Chlorotorm	6.70	5 U agikg
1,1,1-Trichloroethane	< 50	5 Olag kg
Carbon tetrachloride	< 5.0	5.0 ag/sg
1,2-Dichloroethane	< 50	5 (Copyling
Trichloroethene (TCE)	< 50	5.0 µg%g
1,2-Dichloropropane	< 50	5.0 ng kg
Bromodichloromethane	< 5.0	5 O ng kg
cis-1,3-Dichloropropene	< 50	5 0 µg kg
trans-1,3-Dichloropropene	< 50	5.0 ng/kg
1,1,2-Trichloroethane	< 50	5 () 63% kg
Tetrachloroethene (PCE)	< 50	5 O µg kg
Dibromochloromethane	< 5 0	5.0 µg.kg
Chlorobenzene	< 5.0	5 (tag kg
Bromoform	< 50	5 0 µg kg
1,1,2,2-Tetrachloroethane	< 5.0	$5.0 \log kg$
1,3-Dichlorobenzene	< 5 ()	50 ng kg
1,4-Dichlorobenzene	< 50	7 Canaka
1,2-Dichlorobenzene	< 50	Swarkg

Units:

μg/kg

Micrograms per kilogram (parts per billion).

Signed Analyst - Peter Cury

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: 12/10/97

P7-S-1 1.5'

Date Analyzed: 12/10/97

Sample: 7 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MiBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 μg/kg	-
Toluene	< 10.0	10.0 μg/kg	-
Ethylbenzene	< 10.0	10.0 μg/kg	<u>-</u>
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	1
Naphthalene	< 10.0	10.0 µg/kg	-
TPH (DRO)	2.63	1.00 mg/kg²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

µg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

Signed Adarmy Peter T. Guy

Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: Date Analyzed:

12/10/97 12/10/97 Sample: 8 of 48 Method: EPA 8021

Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 10	1.0 μς έ
Chloromethane	< 10	Com.
Vinyl chloride	< 10	· (14.g)
Bromomethane	< 1.0	1.0 j.gT
Chloroethane	< 1.0	1.0 μg (
Trichlorotluoromethane	< 1.0	1 O µg7
1,1-Dichloroethene	< 1.0	rga o r
Methylene chloride	< 1.0	! () jig/
trans-1,2-Dichloroethene	< 10	T O 4.93
1,1-Dichloroethane	< 10	1 o ag T
Chloroform	3.20	T to _{re} g T
1,1,1-Trichloroethane	< 1.0	1 trag4
Carbon tetrachloride	< 1.0	1 9 9 1
1,2-Dichloroethane	< 10	Tgy, O T
Trichloræthene (TCE)	< 10	1 o ,1g i
1,2-Dichloropropane	< 10	1 0 µg"
Bromodichloromethane	< 10	Lo ag ⁿ
cis-1,3-Dichloropropene	< 1 ()	1 (Carp)
trans-1,3-Dichloropropene	< 10	* (* 1.62.)
1,1,2-Trichloroethane	< 10	10g1
Tetrachloroethene (PCE)	< 1.0	1 () pg (
Dibromochloromethane	< 1 ()	tongt
Chlorobenzene	< 10	10 ng l
Bromoform	< 10	1.0 mg l
1,1,2,2-Tetrachloroethane	< 1 ()	* Gag
1,3-Dichlorobenzene	< 10	12.00
1,4-Dichlorobenzene	< 1 ()	1 Juga
1,2-Dichlorobenzene	< 1 ()	$1.0~\rm kg^{\prime\prime}$

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1.	μg/l	Micrograms per liter (parts per billion).

Analyst - Peter Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P7

Date Sampled: 12/10/97 Date Analyzed: 12/10/97 Sample: 8 of 48

Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	1/2.00 µg	•
Benzene	< 2.00	2.00 μg/l	-
Toluene	< 2.00	2.00 µg/l	
Ethylbenzene	< 2.00	2.00 µg/l	
Xylenes (o,m,p)	< 6.00	6.00 µg/l	1
Naphthalene	< 2.00	2.00 µg/l	<u>-</u>
TPH (DRO)	< 0.50	0.50 mg/l²	<u>-</u>

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

 1 µg/l Micrograms per liter (parts per billion).

² mg/l Milligrams per liter (parts per million).

Signed_

Peter T. Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled:

12/10/97

Date Analyzed:

12/10/97

Sample: 9 of 48 Method: EPA 8021

Matrix Water

Analyte	Concentration	Detection Limit
Dichloroditlaoromethane	< 1 ()	* (1 ₄₀ 0.)*
Chloromethane	< 10	Colory.
Vinyl chloride	< 1.0	T. D. roger
Bromomethane	< 10	1.0 ag?
Chloroethane	< 10	† Oak
Trichlorofluoromethane	< 1.0	1.0 ag1
1,1-Dichloroethene	< 10	1.0 ag/1
Methylene chloride	< 10	1.0 .0g%
trans-1,2-Dichloroethene	< 10	10.01
1,1-Dichloroethane	< 10	1.0 ag l
Chloroform	1.20	1.0 ,(g)
1,1,1-Trichioroethane	< 10	7 (0 s.g.)
Carbon tetrachlonde	< 10	5 Og. l
1,2-Dichloroethane	< 10	10.91
Trichloroethene (TCE)	< 10	t o ligh
1,2-Dichloropropane	< 10	1.097
Bromodichloromethane	< 10	1 0 agT
cis-1,3-Dichloropropene	< 10	1.0 ,197
trans-1,3-Dichloropropene	< 10	toringt
1,1,2-Trichloroethane	< 1 ()	* 11
Tetrachloroethene (PCE)	< 1 ()	· (1,,(3, 1
Dibromochloromethane	< 10	1 Cag
Chlorobenzene	< 1.0	Y. C. a.g.
Bromoform	< 1 ()	* Care
1,1,2,2-Tetrachloroethane	< 10	$(x_{i}^{\dagger}, x_{i}^{\dagger})$
1,3-Dichlorobenzene	< 1 ()	2
1,4-Dichlorobenzene	< 1 ()	1.0 ,031
1,2-Dichlorobenzene	< 10	1.0(g.1

Units:

1. µg/l

Micrograms per liter (parts per billion).

Signed Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

Date Sampled: 12/10/97

Date Analyzed: 12/10/97

Method: EPA 8021/OA-2 Matrix: Water

Sample: 9 of 48

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	
Benzene	< 2.00	2.00 μg/l	<u>.</u>
Toluene	< 2.00	2.00 μg/l	-
Ethylbenzene	< 2.00	2.00 μg/l	-
Xylenes (o,m,p)	< 6.00	6.00 μg/l	1
Naphthalene	< 2.00	2.00 μg/l	
TPH (DRO)	< 0.50	0.50 mg/l ²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

Micrograms per liter (parts per billion). μg/l

mg/l Milligrams per liter (parts per million).

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled:

Date Analyzed:

P11-S-1 12/10/97 12/10/97 Sample: 10 of 48 Method: EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 50	5.0 ng kg ¹
Chloromethane	< 50	5 0 ag kg
Vinyl chloride	< 5.0	50 ng kg
Bromomethane	< 5.0	5.0 mg kg
Chloroethane	< 50	50 ag kg
Trichlorotluoromethane	< 50	5 0 ngkg
1,1-Dichloroethene	< 5.0	5 () µg%g
Methylene chlaride	< 5.0	5 0 µg/kg
trans-1,2-Dichloroethene	< 5.0	$5.0~\mathrm{ggkg}$
1,1-Dichloroethane	< 5 ()	5.0 p.g.kg
Chloroform	< 50	7.0 a.g.kg
1,1,1-Trichloroethane	< 50	5.0 ng kg
Carbon tetrachloride	< 5.0	5 O ng kg
1,2-Dichloroethane	< 5.0	5.0 ng kg
Trichloroethene (TCE)	< 50	50 ng kg
1,2-Dichloropropane	< 50	5.0 ngkg
Bromodic hloromethane	< 50	5 O naka
cis-1,3-Dichloropropene	< 50	$\mathbb{P}(C_{i},a_{i}^{*},s,y)$
trans-1,3-Dichloropropene	< 50	5 ()g3.g
1,1,2-Trichloroethane	< 5.0	5 O ng kg
Tetrachloroethene (PCE)	< 5.0	5 O ag kg
Dibromochloromethane	< 50	5 O ng/kg
Chlorobenzene	< 50	50 ag kg
Bromotorm	< 50	$5.0 \mathrm{agkg}$
1,1,2,2-Tetrachloroethane	< 5.0	7 Chaple
1,3-Dichlorobenzene	< 5.0	5 Charles
1,4-Dichlorobenzene	< 5.0	^{Non} ng kg
1,2-Dichlorobenzene	< 5.0	5.0 c q 5.g

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1.	µg/kg	Micrograms per kilogram (parts per billion).
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Signed Fun Guy
Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: **P11-S-1** 12/10/97

Date Sampled: 12/10/97 Date Analyzed: 12/10/97 Sample: 10 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 μg/kg	<u>-</u>
Toluene	< 10.0	10.0 µg/kg	•
Ethylbenzene	< 10.0	10.0 µg/kg	<u> </u>
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	1
Naphthalene	< 10.0	10.0 μg/kg	<u>-</u>
TPH (DRO)	< 1.00	1.00 mg/kg ⁻	-

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

 1 $\mu g/kg$ $^{\prime}$ Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

Signea

Peter T. Guy

Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P11
Date Sampled: 12/11/97
Date Analyzed: 12/11/97

Sample: 11 or 48 Method: EPA 8021 Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 1.0	1.0 pg 1
Chloromethane	< 10	1 (r a.g.)
Vinyl chloride	< 10	· 3.45.1
Bromomethane	< 1 ()	* 0 ,.g.;
Chloroethane	< 1.0	1.0g.1
Trichlorofluoromethane	< 1.0	1 ο μαΤ
1,1-Dichloroethene	< 1.0	1.0 ngT
Methylene chloride	< 1.0	ا يور ن ۱
trans-1,2-Dichloroethene	< 10	10 μg 1
1,1-Dichloroethane	< 10	* (* 1.12)
Chlorotorm	< 1.()	1 0 ag (
1,1,1-Trichloroethane	< 1 ()	i yo. o z
Carbon tetrachlonde	< 1 ()	1 (U ₁ (9))
1,2-Dichloroethane	< 10	1 ogT
Trichloroethene (TCE)	< 10	1.0.784
1,2-Dichloropropane	< 1 ()	1 ()g/l
Bromodichloromethane	< 10	t O ggT
cis-1,3-Dichloropropene	< 10	1 () ; gT
trans-1,3-Oschloropropene	< 10	1.0 0,50
1,1,2-Trichloroethane	< 10	1.9.40
Tetrachloroethene (PCE)	< 10	1.0 1.9
Dibromochloromethane	< 1 ()	* 0 na !
Chlorobenzene	< 10	~ () 1. W. I
Bromotorm	< 1 ()	1 0 pg (
1,1,2,2-Tetrachloroethane	< 1.0	$\Gamma_{\mathbf{p},q} \alpha ^{\frac{1}{2}}$
1,3-Dichlorobenzene	< 10	7 (4.94)
1,4-Dichlorobenzene	< 10	· Ope !
1,2-Dichlorobenzene	< 10	1 2 0 3

Units	
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1. μg/l Micrograms per liter (parts per billion).

Signed Aderbury
Analyst - Peter Guy

Client/Site: Golder Assoc./MARCO Refinery

Sample: 11 of 48 Method: EPA 8021/OA-2 Sample ID: P11 Matrix: Water

Date Sampled: 12/11/97 Date Analyzed: 12/11/97

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 µg/l¹	-
Benzene	< 2.00	2.00 μg/Ι	<u>-</u>
Toluene	< 2.00	2.00 μg/l	
Ethylbenzene	< 2.00	2.00 µg/l	•
Xylenes (o,m,p)	< 6.00	6.00 μg/l	1
Naphthalene	< 2.00	2.00 μg/l	-
TPH (DRO)	0.566	0.50 mg/l²	<u>-</u>

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

Micrograms per liter (parts per billion). μg/l

Milligrams per liter (parts per million). mg/l

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: Date Analyzed: P10 12/11/97

12/11/97

Sample: 12 of 48 Method: EPA 8021 Matrix - Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 1.0	1.0 s.g.T
Chloromethane	< 10	$V(C_{i}, Q_{i})$
Vinyt chloride	< 10	19 ₆ g.
Bromomethane	< 1.0	0.44,1
Chloroethane	< 1.0	1000
Trichlorofluoromethane	< 1.0	1 0 ag 1
1,1-Dichlorœthene	< 10	LO agl
Methylene chloride	< 1 ()	10,03
trans-1,2-Dichloroethene	< 10	: 0 a.g.T
1,1-Dichloroethane	< 10	* (V 1, 1)
Chlorotorm	< 10	Totale.
1,1,1-Inchloroethane	< 10	1000
Carbon tetrachloride	< 10	1.0
1,2-Dichloroethane	< 1.0	20.003
Trichloroethene (TCE)	< 1.0	1991
1,2-Dichloropropane	< 1.0	t (c _a ig/)
Bromodichloromethane	< 1 ()	1.0 .03
cis-1,3-Dichloropropene	< 10	To exact
trans-1,3-Dichloropropene	< 10	$^{\circ}O$, g $^{\circ}$
1,1,2-Trichloroethane	< 10	g., (1.1.
Tetrachloroethene (PCE)	< 10	7.000
Dibromochloromethane	< 1.0	1.04.20
Chiarabenzene	< 1 ()	2. C. 1987
Bramatarm	< 1 ()	* 3 1.Q *
1,1,2,2-Tetrachloroethane	< 1.0	7.374.00
1,3-Dichlorobenzene	< ! ()	1.00
1,4-Dichiorobenzene	< 10	1 Company
1,2-Dichlorobenzene	< 1 ()	2.0 (a.e.)

Units:

1. μg/l

Micrograms per liter (parts per billion).

Signed Analyst - Peter Guy

Franklog C

Client/Site: Golder Assoc./MARCO Refinery Sample: 12 of 48

Sample ID: P10 Method: EPA 8021/OA-2 Matrix: Water

Date Sampled: 12/11/97 Date Analyzed: 12/11/97

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	ا/يوبر 2.00	•
Benzene	< 2.00	2.00 μg/l	<u>-</u>
Toluene	< 2.00	2.00 μg/l	<u>-</u>
Ethylbenzene	< 2.00	2.00 µg/l	-
Xylenes (o,m,p)	< 6.00	6.00 μg/l	1
Naphthalene	< 2.00	2.00 μg/l	-
TPH (DRO)	< 0.50	0.50 mg/l ²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

Micrograms per liter (parts per billion). μg/l

Milligrams per liter (parts per million). mg/l

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Client/Site: Golder Assoc./MARCO Refinery

 Sample ID:
 P12-S-1

 Date Sampled:
 12/11/97

 Date Analyzed:
 12/11/97

Sample: 13 or 48 Method: EPA 8021 Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 5.0	5.0 , g/kg°
Chloromethane	< 50	5 Williams
Vinyl chloride	< 50	$5 O(i,y_i) _{\mathcal{H}}$
Bromomethane	< 5.0	5.0 mg kg
Chloroethane	< 50	5 Organ
Trichlorofluoromethane	< 50	5 0 pg kg
1,1-Dichloroethene	< 5.0	5.0 ng kg
Methylene chloride	< 5.0	5 O ng kg
trans-1,2-Dichloroethene	< 50	5.0 j.g.kg
1,1-Dichloroethane	< 50	50 pekg
Chlorotorm	< 50	$S(G)_{k,k,k,k,k}$
1,1,1-Trichloroethane	< 50	5.0 µg kg
Carbon tetrachloride	< 5.0	5 Canks
1,2-Dichloroethane	< 50	5 0 ружу
Trichloroethene (TCE)	< 50	5 O ng kg
1,2-Dichloropropane	< 5 ()	5.0 ngkg
Bromodichloromethane	< 50	5 O ng kg
cis-1,3-Dichloropropene	< 50	7.0 ng kg
trans-1,3-Dichloropropene	< 5 ()	5 W4. Q + Q
1,1,2-Trichloroethane	< 50	5 (hug kg
Tetrachloroethene (PCE)	< 50	7 () tracky
Dibromochloromethane	< 50	5.0 mg kg
Chlorobenzene	< 50	5.0 pg3.e
Bromotorm	< 5.0	5.0 ng kg
1,1,2,2-Tetrachloroethane	< 50	50 mg kg
1,3-D.chlorobenzene	< 5.0	5 Chappe
1,4-Dichlorobenzene	< 50	5 U sig ∗g
1,2-Dichlorobenzene	< 5 ()	5 () . 197 kg

Units:

1. μg/kg Micrograms per kilogram (parts per billion).

Analyst - Peter Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P12-S-1
Date Sampled: 12/11/97
Date Analyzed: 12/11/97

Sample: 13 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 µg/kg¹	•
Benzene	< 10.0	10.0 μg/kg	<u>-</u>
Toluene	< 10.0	10.0 μg/kg	-
Ethylbenzene	< 10.0	10.0 μg/kg	<u>-</u>
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	1
Naphthalene	< 10.0	10.0 µg/kg	-
TPH (DRO)	< 1.00	1.00 mg/kg²	-

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

 1 µg/kg Micrograms per kilogram (parts per billion).

² mg/kg Milligrams per kilogram (parts per million).

Signed_

Peter T. Guy

Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P12
Date Sampled: 12/11/97
Date Analyzed: 12/11/97

Sample: 14 of 48 Method: EPA 8021 Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 10	1.0 ng ()
Chloromethane	< 1.0	1.0 µg.!
Vinyl chloride	< 1.0	1 O ng i
Bromomethane	< 10	10.03
Chloroethane	< 10	1 () .(g.)
Trichlorofluoromethane	< 1.0	1.0 μg/1
1,1-Dichloroethene	< 10	1 0 .gT
Methylene chloride	< 10	1 0 ag4
trans-1,2-Dichloroethene	< 10	Tg:, 0 1
1,1-Dichloroethane	< 1.0	1 o , g;1
Chloroform	4 00	10.491
1,1,1-Trichloroethane	< 10	1 ي. بي 1
Carbon tetrachloride	< 10	1.0
1,2-Dichloroethane	< 10	1.07.91
Trichloroethene (TCE)	< 10	1.04.61
1,2-Dichloropropane	< 1.0	1.0 µg/l
Bromodichloromethane	< 10	1.0 ag T
cis-1,3-Dichloropropene	< 10	1 0 ag T
trans-1,3-Dichloropropene	< 10	! tringT
1,1,2-Trichloroethane	< 1.0	$1.00 \pm g^{\circ}$
Tetrachloroethene (PCE)	< 1 ()	3 O ang i
Dibromochloromethane	< 10	10.33
Chlorobenzene	< 10	O to:
Bromotorm	< 1.0	10.00
1,1,2,2-Tetrachloroethane	< 10	1 (14.44)
1,3-D:chlorobenzene	< 1 ()	t e agi
1,4-Dichlorobenzene	< 1 ()	YO ligit
1,2-Dichlorobenzene	< 1 ()	1 () (48)

Units:

1. μg/l Micrograms per liter (parts per billion).

Signed Tay 7,

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P12
Date Sampled: 12/11/97
Date Analyzed: 12/11/97

Sample: 14 of 48 Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	-
Benzene	< 2.00	2.00 μg/l	<u>.</u>
Toluene	< 2.00	2.00 μg/l	<u>-</u>
Ethylbenzene	< 2.00	2.00 μg/l	<u>-</u>
Xylenes (o,m,p)	< 6.00	6.00 µg/l	1
Naphthalene	< 2.00	2.00 µg/l	<u> </u>
TPH (DRO)	< 0.50	0.50 mg/l²	

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

 1 µg/l Micrograms per liter (parts per billion).

² mg/l Milligrams per liter (parts per million).

Signed FarGuy Peter T. Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample 1D: Date Sampled: Date Analyzed:

P17 12/11/97 12/11/97 Sample: 15 of 48 Method: EPA 8021

Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 1 ()	1.0 µgT
Chloromethane	< 10	$\Gamma_{20,4} \otimes 1$
Vinyl chloride	< 10	1.04.00
Bromomethane	< 10	1.0 64
Chloroethane	< 10	1.04.0.
Trichlorofluoromethane	< 10	1.0 μg
1,1-Dichloroethene	< 1 ()	1 0 ug l
Methylene chloride	< 1.0	1 0 ngT
trans-1,2-Dichloroethene	< 1.0	1 Ungl
1,1-Dichloroethane	< 10	10g1
Chlorotorm	< 10	1.0 ,027
1,1,1-Trichloroethane	< 10	(2a,0)
Carbon tetrachloride	< 1.0	1 O .(a)
1,2-Dichloroethane	< 10	1.0 ,:g7
Trichloroethene (TCE)	< 1.0	الهر. ١٠٥
1,2-Dichloropropane	< 1.0	ا (پېر ۱
Bromodichloromethane	< 10	1 0 ng 7
cis-1,3-Dichloropropene	< 10	1 () ag.:
trans-1,3-Dichloropropene	< 10	T et ng T
1,1,2-Trichloroethane	< 1.0	1 0 ag i
Tetrachloroethene (PCE)	< 1.0	1 (1 mg l
Dibromochloromethane	< 10	1 0 ng (
Chlorobenzene	< 10	1 0 ag (
Bromoform	< 10	1 0 µg1
1,1,2,2-Tetrachloroethane	< 10	` (C.,(g.))
1,3-Dichlorobenzene	< 10	1 0 ag i
1,4-Dichlorobenzene	< 10	' (1,18)
1,2-Dichlorobenzene	< 10	1.0.00

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1. μg/l

Micrograms per liter (parts per billion).

Analyst - Peter Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P17 Date Sampled: 12/11/97

Date Analyzed: 12/11/97

Sample: 15 of 48

Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	-
Benzene	< 2.00	ا/يو 2.00	·
Toluene	< 2.00	2.00 μg/l	<u> </u>
Ethylbenzene	< 2.00	2.00 μg/l	-
Xylenes (o,m,p)	< 6.00	6.00 µg/l	1
Naphthalene	< 2.00	2.00 µg/l	-
TPH (DRO)	< 0.50	0.50 mg/l²	

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

μg/l Micrograms per liter (parts per billion).

Milligrams per liter (parts per million). mg/l

Peter T. Guy

Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: Date Analyzed:

12/11/97 12/11/97 Sample: 16 of 48 Method: EPA 8021 Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 1.0	10g1
Chloromethane	< 1.0	1.0 .0g (
Vinyl chloride	< 10	3 (U (1) g)
Bromomethane	< 10	$1.0~\mathrm{pg}^{\circ}$
Chloroethane	< 10	1.0 µg'(
Trichlorofluoromethane	< 1.0	1.0 4.9.1
1,1-Dichloroethene	< 10	7 0 ng/1
Methylene chloride	< 1.0	: 0 4.91
trans-1,2-Dichloroethene	< 10	. (1763)
1,1-Dichloroethane	< 10	. 04.8.
Chlorotorm	< 10	* Class
1,1,1-Trichloroethane	< 10	* <u>.</u>
Carbon tetrachloride	< 10	Cago
1,2-Dichloroethane	< 1 ()	° 9.40°
Trichloroethene (TCE)	< 1.0	1.0 48
1,2-Dichloropropane	< 10	T (F.,g.T
Bromodichloromethane	< 10	1 0 .igT
cis-1,3-Dichloropropene	< 10	1 (0 ag)
trans-1,3-Dichloropropene	< 10	C. C. C.
1,1,2-Trichloroethane	< 1.0	ે હામુક
Tetrachloroethene (PCE)	< 10	1 O p.gT
Dibromochloromethane	< 1 ()	Tga O f
Chlorobenzene	< 10	! () .agT
Bromotorm	< 1 ()	* 0 kg l
1,1,2,2-Tetrachloroethane	< 10	0.65
1,3-Dichlorobenzene	< 1 ()	* 0g !
1,4-Dichlorobenzene	< 10) e ag l
1,2-Dichlorobenzene	< 10	10.07

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1. μg/l Micrograms per liter (parts per billion).

Signed Francisco Analyst - Peter Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P19-S-1 3.5' 12/11/97 Date Sampled: 12/11/97 Date Analyzed:

Sample: 17 of 48 Method: EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 5.0	5.0 pg kg '
Chloromethane	< 50	5 0 µg/kg
Vinyl chloride	< 50	5.0 mg/kg
 Bromomethane	< 5.0	5 Ong kg
Chloroethane	< 50	5.0 p.g.kg
Trichlorofluoromethane	< 50	5.0 p.g.kg
1,1-Dichloroethene	< 5.0	5 0 p.g.kg
Methylene chloride	< 5.0	5.0 µg kg
trans-1,2-Dichloroethene	< 50	5.0 ng kg
1,1-Dichloroethane	< 50	5 O µg/kg
Chlorotorm	< 50	5 0 p.g/sg
1,1,1-Trichforcethane	< 5 0	5 () p.g.kg
Carbon tetrachloride	< 5 ()	$\bar{\tau}(0), \bar{y} k \bar{y}$
1,2-Dichloroethane	< 50	5 0 ng kg
Trichloroethene (TCE)	< 5.0	5.0 ag kg
1,2-Dichloropropane	< 50	5.0 µg/kg
Bromodichloromethane	< 5.0	5 () , ₁ 13 kg
cis-1,3-Dichloropropene	< 50	5 Ouglig
trans-1,3-Dichloropropene	< 50	TO soft g
1,1,2-Trichloroethane	< 5.0	50 ng kg
Tetrachloroethene (PCE)	< 5.0	5 O ng kg
Dibromochloromethane	< 5 ()	5 Ougleg
Chlorobenzene	< 50	$5.0 \mu g \kappa g$
Bromoform	< 50	5 Ong kg
1,1,2,2-Tetrachloroethane	< 5 ()	5 Ougeg
1,3-Dichlorobenzene	< 5()	5 chanke
1,4-Dichlorobenzene	<. 5 0	TO LICKE
1,2-Dichlorobenzene	< 5 ()	$\mathbb{R}(\mathcal{O}_{\mathcal{F}}, \mathcal{H}, \mathcal{F}_{\mathcal{F}})$

Units:

1	ug/kg	Micrograms	ner kilogram	(parts pe	r billion)
ι.	ILE NE	micrograms	DCI KIIOKI BIII	(Parts pt	1 47111111111

Signed Analyst - Peter Guy

Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: 12/11/97

Date Analyzed: 12/11/97

P19-S-1 3.5'

Sample: 17 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 μg/kg	•
Toluene	< 10.0	10.0 μg/kg	-
Ethylbenzene	< 10.0	10.0 μg/kg	-
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	11
Naphthalene	< 10.0	10.0 μg/kg	<u>-</u>
TPH (DRO)	4.67	1.00 mg/kg ²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

µg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: Date Analyzed: P17-S-1 12/11/97 12/11/97 Nample: 18 of 48 Method: EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichloroditluoromethane	< 50	5.0 jug kg
Chloromethane	< 50	5 O jugikg
Vinyl chloride	< 50	5 O jig kg
Bromomethane	< 5.0	5.0 µg/kg
Chloroethane	< 50	5 O jig kg
Trichlorofluoromethane	< 50	5 o log kg
1,1-Dichloroethene	< 50	5 0 mg kg
Methylene chloride	< 5.0	5 O ngAg
trans-1,2-Dichloroethene	< 50	5 C pg kg
1,1-Dichloroethane	< 50	50 ngkg
Chlorotorm	< 50	2.04.03.6
1,1,1-Trichioroethane	< 5.0	5 Casted
Carbon tetrachloride	< 50	5 O tag kg
1,2-Dichloroethane	< 50	7 () pg kg
Trichloroethene (TCE)	< 50	5 0 µg kg
1,2-Dichloropropane	< 5.0	ર્કાલ્યાલ ક
Bromodichloromethane	< 50	5 0 mg kg
cis-1,3-Dichloropropene	< 50	5.0 ng kg
trans-1,3-Dichloropropene	< 50	0.400.800
1,1,2-Trichloroethane	< 50	5 Chaka
Tetrachloroethene (PCE)	< 5 0	TOLKR
Dibromochloromethane	< 50	5.0 ngRg
Chlorobenzene	< 50	5.0 jug/kg
Bromoform	< 50	5 t) µg kg
1,1,2,2-Tetrachloroethane	< 50	5 (Fig. Lg
1,3-Dichlorobenzene	< 5.0	5 to deckee
1,4-Dichlorobenzene	< 50	5.0 jug ng
1,2-Dichlorobenzene	< 5 ()	To was log

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1	μg/kg	Micrograms	per l	kilogram i	(parts	per	billion)
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Signed Adabay
Analyst - Peter Guy

Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: 12/11/97

P17-S-1 Date Analyzed: 12/11/97 Sample: 18 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	
Benzene	< 10.0	10.0 µg/kg	·
Toluene	< 10.0	10.0 µg/kg	<u> </u>
Ethylbenzene	< 10.0	10.0 µg/kg	-
Xylenes (o,m,p)	< 30.0	30.0 µg/kg	1
Naphthalene	< 10.0	10.0 μg/kg	
TPH (DRO)	< 1.00	1.00 mg/kg²	<u>-</u>

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

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Client/Site:

Golder Assoc./MARCO Refinery

Sample 1D: Date Sampled: Date Analyzed:

P14 12/12/97 12/12/97 Sample: 19 of 48 Method, EPA 8021

Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 1.0	1.04.g
Chloromethane	< 10	1.0 100
Vinyl chloride	< 1 ()	1 O augh
Bromomethane	< 1.0	1.0 49.1
Chloroethane	< 10	1.0 ,.gT
Trichlorofluoromethane	< 10	! O µgT
1,1-Dichloroethene	< 1.0	Tgu o r
Methylene chloride	< 10	104g1
trans-1,2-Dichloroethene	< 10	1.0 ng
1,1-Dichloroethane	< 10	1 (tag)
Chloroform	< 10	: o ag i
1,1,1-Trichloroethane	< 10	10.661
Carbon tetrachloride	< 10	1 (1),e1
1,2-Dichloroethane	< 1.0	10,.91
Trichloroethene (TCE)	< 1.0	3 (03.93)
1,2-Dichloropropane	< 10	Can O :
Bromodichloromethane	< 10	* C 4.g.!
cis-1,3-Dichloropropene	< 10	* Cug!
trans-1,3-Dichloropropene	< 10	· C 100
1,1,2-Trichloroethane	< 10	7 A 1.12
Tetrachloroethene (PCE)	< 10	* 0 mg l
Dibromoch!oromethane	< 10	$^{\circ}$ $_{0}$ $_{0}$ $_{2}$ $_{3}$
Chlorobenzene	< 1.0	no ang t
Bromoform	< 1 ()	* (* 4:4;)
1,1,2,2-Tetrachloroethane	< :0	* (*4.35)
1,3-Dichlorobenzene	< 10	* 5° 15 Q 1
1,4-Dichlorobenzene	< 10	1000
1,2-Dichlorobenzene	< 10	1.00 (12.1

Units	U	n	1	ts	:
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1. μg/l

Micrograms per liter (parts per billion).

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P14

Method: EPA 8021/OA-2 Matrix: Water

Sample: 19 of 48

Date Sampled: 12/12/97

Date Analyzed: 12/12/97

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	-
Benzene	< 2.00	2.00 µg/l	
Toluene	< 2.00	2.00 μg/l	
Ethylbenzene	< 2.00	2.00 μg/l	
Xylenes (o,m,p)	< 6.00	6.00 μg/l	1
Naphthalene	< 2.00	2.00 μg/l	-
TPH (DRO)	< 0.50	0.50 mg/l²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

Micrograms per liter (parts per billion). μg/l

Milligrams per liter (parts per million). mg/l

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: Date Analyzed: P16 12/12/97

12/12/97 12/12/97 Sample: 20 of 48 Method: EPA 8021 Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 1.0	1.0 µg f
Chloromethane	< 10	1.091
Vinyl chloride	< 1.0	Y O log t
Bromomethane	< 10	1.0 p.g.)
Chloroethane	< 1.0	1.0(4.4)
Trichlorofluoromethane	< 1.0	7 O 418 1
1,1-Dichloroethene	< 1.0	7-0 uga
Methylene chloride	< 10	7.0 µg]
trans-1,2-Dichloroethene	< 1.0	1.0 651
1,1-Dichloroethane	< 1.0	10,01
Chloroform	< 1.0	10421
1,1,1-Trichloroethane	< 10	1.0.49.1
Carbon tetrachloride	< 10	1.0.42
1,2-Dichloroethane	< 10	10.55
Trichloroethene (TCE)	< 10	T 22, O 1
1,2-Dichloropropane	< 10	1 () ₃ :gT
Bromodichloromethane	< 10	1.0 pg l
cis-1,3-Dichloropropene	< 10	rgagor
trans-1,3-Dichtoropropene	< ! 0	Lowell
1,1,2-Trichloroethane	< 10	19694
Tetrachloroethene (PCE)	< 10	1.0 ag 1
Dibromochloromethane	< 1 ()	1.0 , ag [
Chlarobenzene	< 10	1 0 µgT
Bromoform	< 10	1 0 ag l
1,1,2,2-Tetrachioroethane	< 10	1 Cagi
1,3-Dichlorobenzene	< 1.0	* (* ng)
1,4-Dichlorobenzene	< 1.0	1.04%
1,2-Dichlorobenzene	< 1.0	* 344.

Units:

1. μg/l

Micrograms per liter (parts per billion).

Signed Ada Sur Analyst - Peter Guy

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Client/Site: Golder Assoc./MARCO Refinery Sample: 20 of 48

Sample ID: Method: EPA 8021/OA-2 P16 Matrix: Water

Date Sampled: 12/12/97 Date Analyzed: 12/12/97

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	-
Benzene	< 2.00	2.00 μg/l	<u>-</u>
Toluene	< 2.00	2.00 µg/l	
Ethylbenzene	< 2.00	2.00 µg/l	-
Xylenes (o,m,p)	< 6.00	6.00 µg/l	1
Naphthalene	< 2.00	2.00 µg/l	-
TPH (DRO)	< 0.50	0.50 mg/l²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

Micrograms per liter (parts per billion). μg/l

mg/l Milligrams per liter (parts per million).

Client/Site: Golder Assoc./MARCO Refinery

 Sample ID:
 P16-S-1 3.0'

 Date Sampled:
 12/12/97

 Date Analyzed:
 12/12/97

Sample: 21 of 48 Method: EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 5.0	7 Oy kg '
Chloromethane	< 50	5 O jog kg
Vinyl chloride	< 50	5 C ng ky
Bromomethane	< 50	5.0 µg%g
Chloroethane	< 50	5 O ngkg
Trichlorofluoromethane	< 5.0	5.0 ngkg
1,1-Dichloroethene	< 5.0	50 ngkg
Methylene chloride	< 50	5 0 µg kg
trans-1,2-Dichloroethene	< 5.0	5.0 µg/kg
1,1-Dichloroethane	< 50	5.0 µg/kg
Chloroform	< 50	5.0 pg/kg
1,1,1-Trichloroethane	< 50	50 mg/kg
Carbon tetrachloride	< 50	7.0 ng kg
1,2-Dichloroethane	< 5.0	50 mg kg
Trichlorcethene (TCE)	< 50	5 tring kg
1,2-Dichloropropane	< 5 ()	5 () ag kg
Bromodichloromethane	< 5.0	5.0 agkg
cis-1,3-Dichloropropene	< 5 ()	5.0 ng kg
trans-1,3-Dichloropropene	< 50	2. O marchy
1,1,2-Trichloroethane	< 5.0	5 O ng kg
Tetrachloroethene (PCE)	< 50	5.0 mg/kg
D:bromochloromethane	< 50	5 0 ng kg
Chiorobenzene	< 50	5.0 mg/kg
Bromoform	< 5.0	5 U ngAg
1,1,2,2-Tetrachloroethane	< 5 0	5.0 ag kg
1,3-Dichlorobenzene	< 5.0	*Ougkg
1,4-Dichlorobenzene	< 5.0	5 Cougleg
1,2-Dichlorobenzene	< 5 ()	5 O ng kg

Units:

1	ug/kg	Micrograms	per kilogram	(parts per	billion).
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Signed Fides Fungarian Analyst - Peter Guy

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Client/Site: Golder Assoc./MARCO Refinery Sample: 21 of 48

Sample ID: P16-S-1 3.0′ Date Sampled: 12/12/97 Date Analyzed: 12/12/97

Method: EPA 8021/OA-2 Matrix: Soil

Analyte	Concentration	Concentration Detection Limit	
MtBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 μg/kg	<u>-</u>
Toluene	< 10.0	10.0 µg/kg	-
Ethylbenzene	< 10.0	10.0 µg/kg	
Xylenes (o,m,p)	< 30.0	30.0 µg/kg	1
Naphthalene	< 10.0	10.0 µg/kg	<u>-</u>
TPH (DRO)	< 1.00	1.00 mg/kg²	<u>-</u>

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

1 μg/kg Micrograms per kilogram (parts per billion).

² mg/kg Milligrams per kilogram (parts per million).

Signed_

Peter T. Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P2-S-1 3.5'

Date Sampled: Date Analyzed: 12/12/97 12/12/97 Sample: 22 of 48 Method: EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 50	5.0 ng kg1
Chloromethane	< 5.0	5.0 agaig
Vinyt chloride	< 50	$5.00, g \star g$
Bromomethane	< 50	5.0 ng kg
Chloroethane	< 5.0	5 o ag kg
Trichlorofluoromethane	< 5.0	5 O piekg
1,1-Dichlorowthene	< 5 ()	5.0 mg/kg
Methylene chloride	< 5.0	5.0 ng kg
trans-1,2-Dichloroethene	< 50	50 mg kg
1,1-Dichloroethane	< 50	50 ngkg
Chlorotorm	< 50	5 Olag kg
1,1,1-Trichloroethane	< 5.0	5.0 mg/kg
Carbon tetrachloride	< 5 ()	5.0 t.c.kg
1,2-Dichloroethane	< 5 ()	5 0 ка кд
Trichlorcethene (TCE)	< 5.0	5.0 ,63 kg
1,2-Dichloropropane	< 50	5 O .03 kg
Bromodichloromethane	< 50	5.0 µg/kg
cis-1,3-Dichloropropene	< 50	5 O pgkg
trans-1,3-Dichloropropene	< ju	i O we kg
1,1,2-Trichloroethane	< 5.0	7 Cappag
Tetrachloroethene (PCE)	< 50	5 O pig kg
Dibromochloromethane	< 50	5 it was kg
Chlorobenzene	< 50	5.0 mg kg
Bromotorm	< 50	$5.0 \mathrm{argkg}$
1,1,2,2-Tetrachioroethane	< 5 ()	5.0 ag kg
1,3-Dichlorobenzene	< 50	5.0 ag kg
1,4-Dichlorobenzene	< 50	5 Ologikg
1,2-Dichlorobenzene	< 50	5.0 .a. kg

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1. $\mu g/kg$ Micrograms per kilogram (parts per billion).

Signed Analyst - Peter Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P2-S-1 3.5' Date Sampled: 12/12/97 Date Analyzed: 12/12/97

Sample: 22 of 48 Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 µg/kg	-
Toluene	17.9	10.0 μg/kg	•
Ethylbenzene	40.2	10.0 μg/kg	-
Xylenes (o,m,p)	44.2	30.0 μg/kg	1
Naphthalene	495	10.0 μg/kg	<u>-</u>
TPH (DRO)	45.9	1.00 mg/kg²	-

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

¹ μg/kg Micrograms per kilogram (parts per billion).

² mg/kg Milligrams per kilogram (parts per million).

Signed_

Peter T. Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled:

12/12/97

Date Analyzed: 12/12/97 Sample: 23 of 48 Method: EPA 8021

Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 1.0	1.0 ng ("
Chloromethane	< 1.0	1 e ,gT
Vinyl chłonde	< 10	1.000
Bromomethane	< 10	10 (44)
Chloroethane	< 10	1.0 4.9.1
Trichlorofluoromethane	< 10	1 0 ng i
1,1-Dichloroethene	< 10	1.0 , (g.)
Methylene chloride	< 1.0	1.0 ag 1
trans-1,2-Dichloroethene	< 1.0	1.0 ,,g1
1,1-Dichloroethane	< 1 ()	: O 1. C
Ch!orotorm	< 10	* 3 444
1,1,1-Trichloroethane	< 10	1000
Carbon tetrachloride	< 10	1 () µg }
1,2-Dichloroethane	< 10	10.94
Trichioroethene (FCE)	< 1.0	1 υ μη (
1,2-Dichloropropane	< 10	1.03.43
Bromodichloromethane	< 1.0	* Cag?
cis-1,3-Dichloropropene	< 10	0.43
trans-1,3-Dichloropropene	< 10	Cont.
1,1,2-Trichloroethane	< 10	5.5.4
Tetrachloroethene (PCE)	< 10	l o ag l
Dibromochloromethane	< ! ()	to orași.
Chiorobenzene	< 1.0	t o ag l
Bromoform	< 10	Tga O t
1,1,2,2-Tetrachloroethane	< 10	Lough
1,3-Dichlorobenzene	< 10	t o log i
1,4-Dichlorobenzene	ح. ۱ ()	(20, 0)
1,2-Dichlorobenzene	< 1.0	1.0.03

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1. μg/l Micrograms per liter (parts per billion).

Signed Analyst - Peter Guy

Client/Site: Golder Assoc./MARCO Refinery

Sample ID:

Sample: 23 of 48 Method: EPA 8021/OA-2

Matrix: Water

Date Sampled: 12/12/97 Date Analyzed: 12/12/97

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	ا/و2.00 µg	-
Benzene	< 2.00	2.00 μg/l	<u>-</u>
Toluene	< 2.00	2.00 μg/l	-
Ethylbenzene	< 2.00	2.00 μg/l	-
Xylenes (o,m,p)	< 6.00	6.00 µg/l	1
Naphthalene	< 2.00	2.00 μg/l	•
TPH (DRO)	< 0.50	0.50 mg/l²	<u>-</u>

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

μg/l Micrograms per liter (parts per billion).

Milligrams per liter (parts per million). mg/l

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P2

Date Sampled: 12/12/97 Date Analyzed: 12/12/97 Sample: 24 of 48 Method: EPA 8021

Matrix: Water

Analyte	Concentration	Detection Limit
Dichloroditluoromethane	< 1.0	Cong."
Chloromethane	< 10	1 ()(;)
Vinyl chloride	< 1.0	1.091
Bromomethane	< 10	1.04.61
Chloroethane	< 1.0	1.0 a.g.)
Trichlorotluoromethane	< 10	200.91
1,1-Dichloroethene	< 1 ()	1 0 ag 7
Methylene chloride	< 10	! O ;;;g/l
trans-1,2-Dichloroethene	< 1.0	$(y_{a,k})_{\beta}$
1,1-Dichloroethane	< 1.0	10491
Chlorotorm	< 10	1.0 ag l
1,1,1-Frichloroethane	< 10	1,00,10
Curbon tetrachloride	< 10	1 O , e T
1,2-Dichioroethane	4 85	10 og 1
Trichloroethene (TCF)	< 1.0	Supple
1,2-Dichloropropane	< 10	1.0 ng/)
Bromodichloromethane	< 10	tong!
cis-1,3-Dichloropropene	< 10	1 O ag :
trans-1,3-Dichloropropene	< 10	TO A.C.
1,1,2-Trichioroethane	< 10	13.31
Tetrachloroethene (PCE)	< 10	1 (1,1,1)
Dibromochloromethane	< 1.0	To pig i
Chlarobenzene	< 10	* (0.4, e , i
Bromotorm	< 10	* $C(\mathbf{n},\mathbf{g})$
1,1,2,2-Tetrachloroethane	< 1 ()	1 O ng
1,3-Dichlorobenzene	< 10	* 0 6.2
1,4-Dichlorobenzene	< 10	The second of
1,2-Dichlorobenzene	< 10	0.6.2

Units:

1. μ g/l Micrograms per liter (parts per billion).

Signed Jan Sun
Analyst - Peter Guy

Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

Sample: 24 of 48

Method: EPA 8021/OA-2

Date Sampled: 12/12/97

Date Analyzed: 12/12/97

- Matrix:	-VI ater

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	ا/يوµ 2.00	-
Benzene	16.8	2.00 µg/l	
Toluene	9.08	2.00 μg/l	<u>-</u>
Ethylbenzene	7.24	2.00 µg/l	-
Xylenes (o,m,p)	< 6.00	6.00 µg/l	1
Naphthalene	18.9	2.00 μg/l	-
TPH (DRO)	0.552	0.50 mg/l	<u>-</u>

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

Micrograms per liter (parts per billion). μg/l

Milligrams per liter (parts per million). mg/l

Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P14-S-1 12/12/97 Date Sampled: Date Analyzed: 12/12/97

Method: EPA 8021 Matrix: Soil

Sample: 25 of 48

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 5.0	5 O ag ky
Chloromethane	< 50	5 0 og kg
Vinyl chloride	< 50	5 (C.19) KV
Bromomethane	< 50	TO AND KE
Chloroethane	< 50	5.0 pg/sg
Trichlorofluoromethane	< 50	50 pakg
1,1-Dichloroethene	< 5.0	5 () 4.8 KP
Methylene chloride	< 50	5.0 mg/kg
trans-1,2-Dichloroethene	< 50	5 Jacky
1,1-Dichloroethane	< 50	7.0 ng kg
Chlaratorm	< 50	T.O. asykg
1,1,1-I schloroethane	< 5()	5.0 ag ag
Carbon tetrachloride	< 50	5.0 ag ag
1,2-Dichloroethane	< 50	5 Charles
Trichloroethene (TCE)	< 5.0	5 U tog kg
1,2-Dichloropropane	< 50	5.0 pg/kg
Bromodichloromethane	< 50	2×24 O č
cis-1,3-Dichloropropene	< 50	5.0 pg/kg
trans-1,3-Dichloropropene	< 5.0	5 ()(kg
1,1,2-Trichloroethane	< 50	5 (* 1.9 kv
Tetrachloroethene (PCE)	< 50	5 () p.g.+ g
Dibromochloromethane	< 5 ()	50000
Chlorobenzene	< 50	50 ng x
Bromoform	< 50	7 O ng kg
1,1,2,2-Tetrachloroethane	< 5 ()	5 (4 , eg. k.g.
1,3-Dichlorobenzene	< 5.0	5 O ag kg
3,4-Dichlorobenzene	< 50	10 ag kg
1,2-Dichlorobenzene	< 50	2 O against

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1. μg/kg Micrograms per kilogram (parts per billion).

Signed Adar Analyst - Peter Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample: 25 of 48 Sample ID: P14-S-1 Method: EPA 8021/OA-2 Date Sampled: 12/12/97 Matrix: Soil

Date Analyzed: 12/12/97

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 μg/kg	<u>-</u>
Toluene	< 10.0	10.0 μg/kg	-
Ethylbenzene	< 10.0	10.0 μg/kg	-
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	1
Naphthalene	< 10.0	10.0 µg/kg	-
TPH (DRO)	< 1.00	1.00 mg/kg²	-,

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: Date Analyzed:

P6-S-1 2.3' 12/13/97 12/13/97

Sample: 26 of 48 Method: EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 5.0	5.0 pag/kg/
Chloromethane	< 5.0	5 0 гужу
Vinyl chloride	< 50	5.0 mg kg
Bromomethane	< 50	5.0 kg kg
Chloroethane	< 5.0	5.0 pg.kg
Trichlorofluoromethane	< 50	5 Oyarkg
1,1-Dichloroethene	< 50	7.0 ng kg
Methylene chloride	< 5.0	7.0 mg/kg
trans-1,2-Dichloroethene	< 5.0	50 ng kg
1,1-Dichloroethane	< 5.0) Chukk
Chloroform	< 5 ()	T. C. L. C. K. K.
1,1,1-Trichloroethane	< 50	5 Gyatey
Carbon tetrachloride	< 50	5 Ong kg
1,2-Dichloroethane	< 50	5 O ng ky
	< 50	
Trichloroethene (TCE)		5 0 ng kg
1,2-Dichloropropane	< 5.0	5.0 µg%g
Bromodichloromethane	< 5 0	5.0 ng %g
cis-1,3-Dichloropropene	< 5.0	7 C 19 + R
trans-1,3-Dichloropropene	s, 5 ()	March Con
1,1,2-Tri: hloroethane	< 5.0	Sid na kg
Tetrachloroethene (PCE)	< 5.0	5.0 ng kg
Dibromochloromethane	< 5.0	5 Chapka
Chlorobenzene	< 50	5 O ng ku
Bromoform	< 50	5.0 mg/kg
1,1,2,2-Tetrachloroethane	< 5 ()	5.0 mg kg
1,3-Dichlorobenzene	< 5.0	500 g kg
1,4-Dichlarabenzene	< 50	To the log
1,2-Dichloropenzene	< 5 ()	7-0

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1.	μg/kg	Micrograms per	kilogram.	(parts per	billion)
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Client/Site:

Golder Assoc./MARCO Refinery

Sample 1D: Date Sampled: 12/13/97

P6-S-1 2.3'

Date Analyzed: 12/13/97

Sample: 26 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 μg/kg	
Toluene	< 10.0	10.0 μg/kg	
Ethylbenzene	< 10.0	10.0 μg/kg	
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	1
Naphthalene	< 10.0	10.0 μg/kg	
TPH (DRO)	< 1.00	1.00 mg/kg²	-

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

Signed FderGun Peter T. Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled:

12/13/97

Date Analyzed:

12/13/97

Sample: 27 of 48 Method, EPA 8021

Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 10	t o ngT
Chloromethane	< 10	$T_{g,g}$
Vinyl chloride	< 10	YOUNGT
Bromomethane	< 10	! O gg!
Chloroethane	< 1.0	1 Ough
Trichlorofluoromethane	< 10	1.0 j.gT
1,1-Dichloroethene	< 10	1.0 gg 1
Methylene chloride	< 10	10 pg 1
trans-1,2-Dichloroethene	< 1 ()	1 0 ;.gT
1,1-Dichloroethane	< 10	1.0 µg T
Chloroform	< 1.0	1.0 p.g.1
1,1,1-Trichloroethane	< 1.0	* 0, g1
Carbon tetrachloride	< 1 ()	$\tau \circ \iota \cdot g T$
1,2-Dichloroethane	< 10	: C u.g. (
Trichloroethene (TCE)	< 1 ()	10487
1,2-Dichloropropane	< 10	1 0
Bromodichloromethane	< 10	1.0 jigT
cis-1,3-Dichloropropene	< 10	10 mg l
trans-1,3-Dichloropropene	< 10	10 ag (
1,1,2-Trichloroethane	< 1.0	1 0 ag1
Tetrachloroethene (PCE)	< 1.0	3.0 ag.,
Dibromochloromethane	< 10	2. O to O .
Chlorobenzene	< 10	* O weil
Bromatorm	< 10	1 O sage
1,1,2,2-Tetrachloroethane	< 1 ()	* 0 ng 1
1,3-Dichlorobenzene	< 10	1.0 ag l
1,4-Dichiarabenzene	<. 10	10.00
1,2-Dichlorobenzene	< 10	2000

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U	11	ı	ι	5	

1. μg/l

Micrograms per liter (parts per billion).

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Golder Assoc./MARCO Refinery Client/Site:

Sample ID: P6

Date Sampled: 12/13/97 Date Analyzed: 12/13/97

Sample: 27 of 48

Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	-
Benzene	< 2.00	2.00 μg/l	
Toluene	< 2.00	2.00 μg/l	<u> </u>
Ethylbenzene	< 2.00	2.00 μg/l	<u> </u>
Xylenes (o,m,p)	< 6.00	6.00 μg/l	11
Naphthalene	< 2.00	2.00 μg/l	<u>-</u>
TPH (DRO)	< 0.50	0.50 mg/l²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

 $\mu g/\Gamma$ Micrograms per liter (parts per billion).

mg/l Milligrams per liter (parts per million).

Signed Adulum Peter T. Guy

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Client/Site:

Golder Assoc/MARCO Refinery

Sample ID:

P4-S-1 3.8'

Date Sampled: Date Analyzed: 12/13/97 12/13/97 Sample 28 of 48 Method: EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 20 0	20 0 ng kg
Chloromethane	< 20 0	20.0 ngkg
Vinyl chloride	< 20.0	20 0 ag kg
Bromomethane	< 20.0	200 ag kg
Chloroethane	< 20 0	20 0 ag kg
Trichlorofluoromethane	< 20.0	20 0 ag/kg
1,1-Dichloroethene	< 20.0	20 0 ag kg
Methylene chloride	< 20 0	20 0 jig kg
trans-1,2-Dichloroethene	< 20.0	20.0 µg/kg
1,1-Dichloroethane	< 20 0	20 0 ng Kg
Chlorotarm	< 20.0	20 Og kg
1,1,1-Trichloroethane	< 20.0	20.0
Carbon tetrachloride	< 20.0	20 Opekg
1,2-Dichloroethane	< 20 €	20 o nakp
Trichloroethene (TCE)	< 20.0	20 0 p.g.kg
1,2-Dichloropropane	< 20 0	20.0 µg kg
Bromodichloromethane	< 20 0	20 O hgkg
cis-1,3-Dichlaropropene	< 20 0	20 O ug kg
trans-1,3-Dichloropropene	< 20.0	200 pakg
1,1,2-Trichloroethane	< 20 0	$\mathcal{L}_{+}(\mathcal{O}_{+}, g_{+}, g_{-})$
Tetrachloroethene (PCE)	< 20.0	20 0 pg sg
Dibromochloromethane	< 20 0	200 O Lycky
Chlorobenzene	< 20.0	2000 pg kg
Bromoform	< 20 0	20 0 µg kg
1,1,2,2-Tetrachloroethane	< 20.0	20 O log kg
1,3-Dichlorobenzene	< 200	20 O ag kg
1,4-Dichlorobenzene	< 200	20 0 000
1,2-Dichlorobenzene	< 20.0	20 G py kg

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1.	μg/kg	Micrograms per	kilogram	(parts per	bil	lion).
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Signed / Jan Jung
Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P4-S-1 3.8' 12/13/97

Date Sampled: 12/13/97 Date Analyzed: 12/13/97 Sample: 28 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MiBE	< 40.0	40.0 μg/kg¹	-
Benzene	624	40.0 μg/kg	<u>-</u>
Toluene	1340	40.0 μg/kg	<u>-</u>
Ethylbenzene	673	40.0 μg/kg	-
Xylenes (o,m,p)	1350	120 µg/kg	1
Naphthalene	6170	10.0 μg/kg	<u>-</u>
TPH (DRO)	163	1.00 mg/kg²	-

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

 1 µg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

Signed

Peter T. Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

12/13/97 Date Sampled:

Date Analyzed:

12/13/97

Sample: 29 of 48 Method: EPA 8021

Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 20	2 0 ,.gT
Chloromethane	< 2.0	2.0 a.g.1
V:nyl chionde	< 20	2097
Bromomethane	< 20	2.0 (68)
Chloroethane	< 2.0	2.0 (13)
Trichiorofluoromethane	< 20	2.0 ag i
1,1-Dicinloroethene	< 20	2.0 a.g.1
Methylene chloride	< 2.0	2.0 444.1
trans-1,2-Dichloroethene	< 20	2.0 40
1,1-Dichloroethane	< 20	2.0 mg/l
Chlorotorm	< 2.0	2.0 mg.
1,1,1-Trichloroethane	< 20	- 1 max
Carbon tetrachloride	< 2.0	2.0 mg/
1,2-Dichloroethane	< 2.0	2 (0.4.9)
Trichloroethene (TCE)	< 20	20 ag:
1,2-Dichloropropane	< 20	2 () ag (
Bromodic hloromethane	< 2 0	2 () ag.)
cis-1,3-Dichlaropropene	< 2.0	2.0 mg (
trans-1,3-Dichloropropene	< 2.0	2.0 (4)
1,1,2-Trichioroethane	< 2.0	= 0 68
Tetrachloroethene (PCE)	< 2.0	20 ng.
Dibromochloromethane	< 2.0	20 4.9
Chlorobenzene	< 2 ()	2.0 4.25
Bromotorm	< 2 0	2 O ag (
1,1,2,2-Tetrachforoethane	< 2.0	20 mg
1,3-D.chlorobenzene	< 2.0	200.00
1,4-Dichlorobenzene	< 2.0	2 (Cag)
1,2-Dichlarobenzene	< 2.0	197.0

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1. µg/l

Micrograms per liter (parts per billion).

Analyst - Peter Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P4

Date Sampled: 12/13/97 Date Analyzed: 12/13/97 Sample: 29 of 48

Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 4.00	4.00 μg/l¹	-
Benzene	645	4.00 μg/l	-
Toluene	367	4.00 μg/l	-
Ethylbenzene	148	4.00 μg/l	
Xylenes (o,m,p)	150	12.0 μg/l	1
Naphthalene	202	4.00 μg/l	-
TPH (DRO)	1.73	0.50 mg/l ²	<u>-</u>

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

 1 $\mu g/l$ Micrograms per liter (parts per billion).

² mg/l Milligrams per liter (parts per million).

Peter T. Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P5
Date Sampled: 12/13/97
Date Analyzed: 12/13/97

Sample: 30 of 48 Method: EPA 8021 Matrix: Water

Analyte	Concentration	Detection Limit
Dichloroditluoromethane	< 1 ()	1000
Chloromethane	< 10	1.001
Vinyl chloride	< 1.0	1.0.,0;.
Bromomethane	< 10	$^{\circ}$ α_{p} $_{\mathbf{g}}$ $^{\circ}$
Chloroethane	< 1 ()	1.9 ng t
Trichlorofluoromethane	< 1.0	1.0 p.gT
1,1-Dichloroethene	< 10	I O por
Methylene chloride	< 1.0	10 1.90
trans-1,2-Dichloroethene	< 1.0	1 Oug
1,1-Dichloroethane	< 1.0	10.197
Chloroform	< 10	1.0 ₀ .gT
1,1,1-Trichloroethane	< 1 ()	To a C
Carbon tetrachloride	< 1.0	1.0 aug 1
1,2-Dichloroethane	< 10	* O , g
Trichloroethene (TCE)	< 1.0	10 ag.
1,2-Dichloropropane	< 1.0	1 O age
Bromodichloromethane	< 10	1 () µg; i
cis-1,3-Dichloropropene	< 10	1 () ag ()
trans-1,3-Dichloropropene	< 10	1 (c. 20%)
1,1,2-Tr.chloroethane	< 1.0	towa.
Tetrachloroethene (PCE)	< 10	1.0 ,(g)
Dibromochloromethane	< 10	
	< 10	1 O mg i
Chiorobenzene	< 10	1 Olay i
Bromoform		1 0 mg l
1,1,2,2-Tetrachloroethane	< 10	2.0 mg /
1,3-Dichlorobenzene	< 10	1 dg (
1,4-Dichlorobenzene	< 1.0	
1,2-Dichforobenzene	< 10	1 14.4

Units	;
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1. $\mu g/l$ Micrograms per liter (parts per billion).

Signed Fide Guy
Analyst - Peter Guy

Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P5

Date Sampled: 12/13/97 Date Analyzed: 12/13/97 Sample: 30 of 48

Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	-
Benzene	12.0	2.00 µg/l	-
Toluene	15.1	2.00 µg/l	·
Ethylbenzene	2.18	2.00 µg/l	-
Xylenes (o,m,p)	< 6.00	6.00 μg/l	1
Naphthalene	< 2.00	2.00 μg/l	-
TPH (DRO)	< 0.50	0.50 mg/l ²	-

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

 1 µg/l Micrograms per liter (parts per billion).

² mg/l Milligrams per liter (parts per million).

Peter T. Guy

Peter I. Gu

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Client/Site: Golder Assoc./MARCO Refinery

 Sample ID:
 P5-S-1 10.9'

 Date Sampled:
 12/13/97

 Date Analyzed:
 12/13/97

Sample: 33 of 48 Method: EPA 8023 Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 5 ()	5 () , (g k g)
Chloromethane	< 5 ()	5 O astry
Vinyl chloride	< 5.0	5 O washig
Bromomethane	< 5 ()	7.Canka
Chloroethane	< 5.0	5 O ag kg
Trichlorofluoromethane	< 5.0	5.0 ng kg
1,1-Dichloroethene	< 5.0	50 ng kg
Methylene chloride	< 5.0	5 O ng kg
trans-1,2-Dichloroethene	< 5.0	5.0 ag kg
1,1-Dichloroethane	< 50	5 O ng kg
Chlorotorm	< 50	0.0 , g, kg
1,1,1-Trichloroethane	< 5.0	To Charles at
Carbon tetrachloride	< 50	7.0 make
1,2-Dichloroethane	< 50	5.0 ng kg
Trichloroethene (TCE)	< 50	5 Carkg
1,2-Dichloropropane	< 5.0	5.0 mg.kg
Bromodichloromethane	< 5 ()	5.0 mg/kg
cis-1,3-Dichloropropene	< 5.0	2.0 ngAg
trans-1,3-Dichloropropene	< 5.0	Contact
1,1,2-Trichloroethane	< 5 ()	$\mathbb{R}[0]_{0}(0)_{0}$
Tetrachloroethene (PCE)	< 50	5 O mg/kg
Dibromochloromethane	< 50	50 mkg
Chlorobenzen e	< 50	5.0 ag kg
Bromotor m	< 5 ()	5 O ng kg
1,1,2,2-Tetrachloroethane	< 50	5 of p.g.kg
1,3-Dichlorobenzene	< 5.0	5.0 agkg
1,4-Dichlorobenzene	< 50	5.0 p.g.kg
1,2-Dichlorobenzene	< 5.0	100 M KV

Units:

1.	ug/kg	Micrograms	per kilogram	(parts per	billion)
	11 PM 11 PM	THE CONTRACTOR	De Livino Pigarin	Aparts per	

Signed Johnson
Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P5-S-1 10.9' Date Sampled: 12/13/97 Date Analyzed: 12/13/97

Sample: 31 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 μg/kg	<u>-</u>
Toluene	< 10.0	10.0 μg/kg	-
Ethylbenzene	< 10.0	10.0 μg/kg	-
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	1
Naphthalene	< 10.0	10.0 μg/kg	<u>-</u>
TPH (DRO)	< 1.00	1.00 mg/kg ²	

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

Client/Site: Golder Assoc:/MARCO Refinery

Sample ID: P3
Date Sampled: 12/13/97
Date Analyzed: 12/13/97

Sample: 32 of 48 Method: EPA 8021 Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 10	Tg ₁₄ 0 f
Chloromethane	< 10	10,00
Vinyl chloride	< 1 ()	1.0 ,031
Bromomethane	< 10	1.0.91
Chloroethane	< 10	1.0.407
Trichlorofluoromethane	< 10	1.0 , ig.!
1,1-Dichloroethene	< 1.0	1 0 µgT
Methylene chloride	< 10	1.0 p.gT
trans-1,2-Dichloroethene	< 10	1.0 ag T
1,1-Dichloroethane	< 1.0	1 ()gT
Chloroform	< 10	1.0g1
1,1,1-Trichloroethane	< 10	1 (0 a.g.)
Carbon tetrachloride	< 1.0	Long!
1,2-Dichloroethane	< 10	Y O p.gT
Trichloroethene (ECE)	< 10	1.0 ,19,1
1,2-Dichloropropane	< 10	Fgs, 0 !
Bromodichloromethane	< 1 0	1 0 .021
cis-1,3-Dichloropropene	< 10	1.0 ,.19.1
trans-1,3-Dichloropropene	< 1.0	1.00,000
1,1,2-Trichloroethane	< 10	† O ng
Tetrachloroethene (PCE)	< 1 ()	* 0 60
Dibromochloromethane	< 1 ()	1.0 pg :
Chlorobenzene	< 1.0	1.0 p.g.1
Bromotorm	< 10	10 ag (
1,1,2,2-Tetrachloroethane	< 10	1.0 ag l
1,3-Dichlorobenzene	< 1.0	1.0 , (2.1
1,4-Dichlorobenzene	< 10	1000
1,2-Dichlorobenzene	< 10	* 37 474

Units:

1. It is a second of the party per bring	oarts per billioni.	(parts	liter	per	Micrograms	μg/l	1.
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Signed Johnson
Analyst - Peter Guy

Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P3

Date Sampled: 12/13/97

Date Analyzed: 12/13/97

Sample: 32 of 48

Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	ا/و2.00 لل	-
Benzene	< 2.00	2.00 µg/l	-
Toluene	< 2.00	2.00 µg/l	
Ethylbenzene	< 2.00	2.00 µg/l	·
Xylenes (o,m,p)	< 6.00	6.00 µg/l	1
Naphthalene	< 2.00	2.00 μg/l	<u>-</u>
TPH (DRO)	< 0.50	0.50 mg/l²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

Micrograms per liter (parts per billion). μg/l

mg/l Milligrams per liter (parts per million).

Peter T. Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P3-S-1 12/13/97

Date Sampled: Date Analyzed:

12/13/97

Sample: 33 of 48 Method EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 5.0	50 mg kg
Chloromethane	< 50	5.0 ag/kg
Vinyl chloride	< 5.0	5.0 ng kg
Bromomethane	< 50	5.0 µg/kg
Chloroethane	< 50	5 chag kg
Trichlorofluoromethane	< 5.0	7.0 ngkg
1,1-Dichloroethene	< 50	50 ng kg
Methylene chloride	< 5.0	5 O ag kg
trans-1,2-Dichloroethene	< 5.0	5.0 µgkg
1,1-Dichloroethane	< 5.0	5.0 ngkg
Chloroform	< 50	5 O ng kg
1,1,1-Trichloroethane	< 5.0	5 (0 p.g + g
Carbon tetrachloride	< 5 ()	5.0 ag x g
1,2-Dichloroethane	< 50	Coughe
Trichloroethene (TCE)	< 5 ()	5 C 1. 1. 1. 1. 1.
1,2-Dichloropropane	< 5.0	50 ng kg
Bromodic hloromethane	< 5.0	5.0 µgkg
cis-1,3-Dichloropropene	< 50	5 O 112 Kg
trans-1,3-Dichloropropene	< 5.0	5 O nakg
1,1,2-Trichloroethane	< 50	5 O 100 kg
Tetrachioroethene (PCE)	< 5 ()	5 Cagkg
Dibromochloromethane	< 50	5.0 a.g.kg
Chlorobenzene	< 5 0	$5.0 \mu g kg$
Bromotorm	< 50	5 0 ag kg
1,1,2,2-Tetrachloroethane	< 50	5.0 ng kg
1,3-Dichlorobenzene	< 50	5.0 ng kg
1,4-Dichlorobenzene	< 50	5.0 mg/kg
1,2-Dichlorobenzene	< 5 ()	5 of coupling

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1. $\mu g/kg$ Micrograms per kilogram (parts per bilion).

Signed Adarbay
Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: 12/13/97

P3-S-1 Date Analyzed: 12/13/97 Sample: 33 of 48

Method: EPA 8021/OA-2

Matrix: Soil-

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	
Benzene	< 10.0	10.0 μg/kg	<u>-</u>
Toluene	< 10.0	10.0 μg/kg	
Ethylbenzene	< 10.0	10.0 μg/kg	<u> </u>
Xylenes (o,m,p)	< 30.0	30.0 µg/kg	1
Naphthalene	< 10.0	10.0 µg/kg	<u></u>
TPH (DRO)	1.41	1.00 mg/kg²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P15
Date Sampled: 12/13/97
Date Analyzed: 12/13/97

Sample: 34 of 48 Method: EPA 8021 Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 10	1.0 a.c.
Chloromethane	< 10	E.O. prog.)
Vinyl chloride	< 10	1.0 .19.1
Bromomethane	< 10	1.0
Chloroethane	< 10	2.0
Trichlorofluoromethane	< 10	1.0 p.g.t
1,1-Dichloroethene	< 10	10 (4)
Methylene chloride	< 10	7.0 ag.
trans-1,2-Dichloroethene	< 10	1.0 agT
1,1-Dichloroethane	< 1.0	1.0 .127
Chloroform	< 10	10,01
1, 1, 1-Trichloroethane	< 10	the light
Carbon tetrachloride	< 10	$^{\circ}$ $<$ $\log t$
1,2-Dichloroethane	< 10	10g)
Trichloroethene (TCE)	< 10	1 Jugi
1,2-Dichloropropane	< 10	1.04.60
Bromodichloromethane	< 1.0	$1.0~{ m kg}^{3}$
cis-1,3-Dichloropropene	< 1.0	1 O ag
trans-1,3-Dichloropropene	< 10	1 of 60g
1,1-2-Trichloroethane	< 1.0	The same
Tetrachloroethene (PCE)	< 10	1.0 ng (
Dibromochloromethane	< 10	1.0 (6)
Chlorobenzene	< 10	2 (O $_{4}$ (g) 2
Bromotorm	< 10	1.0 ((g))
1,1,2,2-Tetrachloroethane	< 1.0	10,00
1,3-Dichlorobenzene	< 10	· Cast
1,4-Dichiorobenzene	< 10	1.10
1,2-Dichlorobenzene	< 1 ()	* 1 - 1/1°

Units:

1.	μg/l	Micrograms per liter (parts per	billion).
		$\alpha \wedge$	

Analyst - Peter Guy

Client/Site: Golder Assoc./MARCO Refinery

Sample 1D: P15
Date Sampled: 12/13/97
Date Analyzed: 12/13/97

Sample: 34 of 48 Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	-
Benzene	< 2.00	2.00 µg/l	-
Toluene	< 2.00	2.00 μg/l	<u>-</u>
Ethylbenzene	< 2.00	2.00 µg/l	<u>-</u>
Xylenes (o,m,p)	< 6.00	6.00 μg/l	1
Naphthalene	< 2.00	2.00 µg/l	<u>-</u>
TPH (DRO)	< 0.50	0.50 mg/l²	-

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

 1 µg/l Micrograms per liter (parts per billion).

² mg/l Milligrams per liter (parts per million).

Signed,

Peter T. Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: M4
Date Sampled: 12/13/97
Date Analyzed: 12/13/97

Sample: 35 of 48 Method: EPA 8021 Matrix: Water

Analyte	Concentration	Detection Limit
Dichforodifluoromethane	< 10	1.0 mg /
Chloromethane	< 10	Egn O I
Vinyl chloride	< 10	1.0gT
Bromomethane	< 10	* $\partial_{\mathbf{q}}$, \mathbf{q} ,
Chloroethane	< 1.0	1 O kg i
Trichlorofluoromethane	< 1.0	TONYT
1,1-Dichloroethene	< 10	1.0
Methylene chloride	< 1.0	* 0 pg"
trans-1,2-Dichloroethene	< 10	10 49
1,1-Dichloroethane	< 10	* 0 mg !
Chloroform	< 10	1 () .ig.)
1,1,1-Trichloroethane	< 1.0	100,01
Carbon tetrachloride	< 10	$\gamma_{ij}(q,q_i)$
1,2-Dichloroethane	< 10	· · · · · · · · ·
Trichloroethene (TCE)	< 1.0	1.0 ag.1
1,2-Dichloropropane	< 10	1.0 mg/t
Bromodichloromethane	< 10	10 :: g !
cis-1,3-Dichloropropene	< 10	$\Sigma(0_{p}; \mathbf{g})$
trans-1,3-Dichloropropene	< 1 ()	1.0 mg 7
1,1,2-Trichforoethane	< 1.0	* x , y ·
Tetrachloroethene (PCE)	< 10	* C 1.14
Dibromochioromethane	< 10	· Orce
Chlorobenzene	< 10	* Carr
Bromatorm	< 10	10.91
1,1,2.2-Tetrachloroethane	<; 1 ()	* (0 s.g.)
1,3-Dichlorobenzene	< : 0	10.41
1,4-Dichlorobenzene	< 10	tungt
্য,2-Dichlorobenzene	•, • ()	1000

Units:

1. μg/l Micrograms per liter (parts per billion).

Signed Francium
Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

Method: EPA 8021/OA-2

Date Sampled: 12/13/97

Date Analyzed: 12/13/97

Matrix: Water

Sample: 35 of 48

Concentration **Detection Limit Analyte** Flag **MtBE** < 2.00 $2.00 \, \mu g/l^{1}$ Benzene < 2.00 2.00 µg/l $2.00 \mu g/l$ Toluene < 2.00 Ethylbenzene < 2.00 $2.00 \mu g/l$ < 6.00 6.00 µg/l Xylenes (o,m,p) Naphthalene < 2.00 $2.00 \mu g/l$ 0.50 mg/l² TPH (DRO) < 0.50

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

μg/l Micrograms per liter (parts per billion).

Milligrams per liter (parts per million). mg/l

Signed

Peter T. Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: M1
Date Sampled: 12/13/97
Date Analyzed: 12/13/97

Sample: 36 of 48 Method: EPA 8021 Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 1.0	1 O µg F
Chloromethane	< 10	TOUGT
Vinyl chloride	< 1.0	1.0 µgT
Bromomethane	< 10	1.0 μg/1
Chloroethane	< 10	1.0 ng1
Trichlorofluoromethane	< 1.0	1.0 μgT
1,1-Dichloroethene	< 1.0	1 0 µg/i
Methylene chloride	< 10	1.0 ngT
trans-1,2-Dichloroethene	< 10	12.0
1,1-Dichloroethane	< 1.0	1 () µg'.
Chloroform	< 1.0	1 0 ng
1,1,1-Trichloroethane	< 1.0	Fg., o :
Carbon tetrachloride	< 10	To del
1,2-Dichloroethane	< 10	r. p.,.g.7
Trichloroethene (TCE)	< 1.0	· court
1,2-Dichloropropane	< 1.0	1 C ag1
Bromodichloromethane	< 1.0	1 0 µg/i
cis-1,3-Dichloropropene	< 10	2.0 mg%
trans-1,3-Dichloropropene	< 10	1.0 μg?
1,1,2-Trichloroethane	< 10	1.0 .0; (
Tetrachloroethene (PCE)	< 10	voig.
Dibromochloromethane	< 10	10.191
Chlorobenzene	< 1 ()	10,91
Bromoform	< 1.()	10 ag1
1,1,2,2-Tetrachloroethane	< 10	10 (18)
1,3-Dichlorobenzene	< 1.0	* (c , , g)
1,4-Dichlorobenzene	< 10	1.0 ag (
1,2-Dichlorobenzene	< 10	2.0 .09.1

Units:

1. μg/l Micrograms per liter (parts per billion).

Signed Analyst - Peter Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: M1

Date Sampled: 12/13/97 Date Analyzed: 12/13/97 Sample: 36 of 48 Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	-
Benzene	372	2.00 µg/l	<u>-</u>
Toluene	19.6	2.00 μg/l	<u></u>
Ethylbenzene	< 2.00	2.00 μg/l	<u>-</u>
Xylenes (o,m,p)	< 6.00	6.00 μg/l	11
Naphthalene	< 2.00	2.00 μg/l	<u> </u>
TPH (DRO)	< 0.50	0.50 mg/l ²	<u></u>

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

 1 µg/l Micrograms per liter (parts per billion).

2 mg/l Milligrams per liter (parts per million).

Signed__ D-+-- T

Peter T. Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: **P13** 12/13/97

Date Analyzed: 12/13/97

Sample: 37 of 48 Method: EPA 8021 Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 10	1.0 ag/i
Chloromethane	< 10	1.0 .agt
Vinyl chloride	< 1 ()	10.01
Bromomethane	< 10	1.0 .001
Chloroethane	< 1 ()	10,94
Trichlorofluoromethane	< 1 ()	10.687
1,1-Dichloroethene	< 10	1.0
Methylene chloride	< 1.0	Tg., 0 f
trans-1,2-Dichloroethene	< 1.0	10,49
1,1-Dichloroethane	< 10	2.0 (44)
Chloroform	< 10	1.0 4.9 (
1,1,1-Trichloroethane	< 1.0	* 1. p. 4. (
Carbon tetrachloride	< 1 ()	4. 4. N
1,2-Dichloroethane	< 10	1.0 pg
Trichloroethene (TCE)	< 1.0	1 Class
1,2-Dichloropropane	< 10	* () 4.g.)
Bromodichloromethane	< 1.0	2.04.2
cis-1,3-Dichloropropene	< 1 ()	\$2.4. 1
trans-1,3-Dichloropropene	< ! ()	2.00404
1,1,2-Trichioroethane	< 10	* Carr
Tetrachloroethene (PCE)	< 10	1.0 a.g.)
Dibromochloromethane	< 1.0	1 (1.1.2.)
Chlorobenzene	< 10	$\mathcal{O}_{(a)}\mathcal{O}_{(a)}^{b}$
Bromotorm	< 1 ()	1.0 ag (
1,1,2,2-Tetrachloroethane	< 10	1 20.00
1 ,3-Dichlorobenzene	< 1.0	10.63
1,4-Dichlorobenzene	< 1 ()	$\gamma \alpha_{ABC}$
1,2-Dichlorobenzene	< 1 ()	* 0 set

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\cup	1 1	١	٠.	,	•

1. μg/l Micrograms per liter (parts per billion).

Analyst - Peter Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P13

Date Sampled: 12/13/97 Date Analyzed: 12/13/97 Sample: 37 of 48 Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	-
Benzene	< 2.00	2.00 นฺg/l	<u>-</u>
Toluene	< 2.00	2.00 μg/l	<u> </u>
Ethylbenzene	< 2.00	2.00 μg/l	· · · · · · · · · · · · · · · · · · ·
Xylenes (o,m,p)	< 6.00	6.00 μg/l	1
Naphthalene	< 2.00	2.00 µg/l	-
TPH (DRO)	< 0.50	0.50 mg/l ²	<u>-</u>

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

Micrograms per liter (parts per billion). $\mu g/l$

Milligrams per liter (parts per million). mg/l

		-

Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P13-S-1 12/13/97

Date Sampled: Date Analyzed: 12/13/97 12/14/97 Sample: 38 of 48 Method: EPA 8021

Matrix, So L

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 50	5.0 pg/kg"
Chloromethane	< 50	5.0 p.g.kg
Vinyl chloride	< 5.0	5.0 p.g/kg
Bromomethane	< 5.0	5 O g + g
Chloroethane	< 50	5 O Lyckg
Trichlorofluoromethane	< 5.0	5 Оруску
1,1-Dichloroethene	< 5.0	5.0 .00 kg
Methylene chloride	< 5.0	5.0 ag.kg
trans-1,2-Dichloroethene	< 5.0	5.0 ag kg
1,1-Dichloroethane	< 50	5.0 ng kg
Chloroform	< 5.0	5.0 mg kg
1,1,1-Trichloroethane	< 50	5 July 2
Carbon tetrachloride	< 50	5.0 mg kg
1,2-Dichloroethane	< 50	5 o top kg
Trichloroethene (TCE)	< 5.0	5 to p.g.s.g
1,2-Dichloropropane	< 50	5 Organiza
Bromodichloromethane	< 5.0	5.0 mg/kg
cis-1,3-Dichloropropene	< 5.0	5 O agrkg
trans-1,3-Dichloropropene	< 5.0	$5.00 \log kg$
1,1,2-Trichloroethane	< 5.0	5 thing kg
Tetrachloroethene (PCE)	< 50	5 U makg
Dibromocnloromethane	< 50	5 d nake
Chlorabenzene	< 50	ે છે હતું હતું
Bromoform	< 5.0	5 0 да кр
1,1,2,2-Tetrachloroethane	< 5.0	$5.00 \mathrm{ag/kg}$
1,3-Dichlorobenzene	< 50	7.0 mg kg
1,4-Dichlorobenzene	< 5.0	5.0 p.e.sg
1,2-Dichlorobenzene	< 5.0	5 to pag≯g

Units:

1.	ug/kg	Micrograms	per kilogram	(parts per	billion
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Signed Your U

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Client/Site: Golder Assoc./MARCO Refinery Sample: 38 of 48

Sample ID: P13-S-1 Method: EPA 8021/OA-2 Matrix: Soil

Date Sampled: 12/13/97 Date Analyzed: 12/14/97

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μ g/ kg ³	
Benzene	< 10.0	10.0 μg/kg	<u>-</u>
Toluene	< 10.0	10.0 μg/kg	<u>-</u>
Ethylbenzene	< 10.0	10.0 µg/kg	<u>-</u>
Xylenes (o,m,p)	< 30.0	30.0 µg/kg	11
Naphthalene	< 10.0	10.0 μg/kg	<u> </u>
TPH (DRO)	< 1.00	1.00 mg/kg²	<u>-</u>

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

		<u> </u>

Client/Site: Golder Assoc/MARCO Refinery

Sample ID: P20
Date Sampled: 12/13/97
Date Analyzed: 12/14/97

Sample: 39 of 48 Nethod: EPA 8021 Natrix - Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 1.0	1.0 kg/*
Chloromethane	< 1 ()	* O 4.9
Vinyl chloride	< 1.0	* (1 ,ig)
Bromomethane	< 10	10.42.
Chlorcethane	< 1.0	1.0 (0.0)
Trichlorofluoromethane	< 1.0	10,497
1,1-Dichloroethene	< 10	1.0 ,027
Methylene chloride	< 1.0	1 ο μgΤ
trans-1,2-Dichloroethene	< 1.0	1.0 ,:94
1,1-Dichloroethane	< 1.0	1.0 µg.1
Chloroform	< 10	1 e ,.gT
1,1,1-Trichloroethane	< 10	· (+,,g, i
Carbon tetrachloride	< 10	2 Coping o
1,2-Dichloroethane	< 10	20091
Trichloroethene (TCE)	< 1.0	2.0 p.g.,
1,2-Dichloropropane	< 10	0,1,97
Bromodichloromethane	< 1 ()	1.0 µg/i
cis-1,3-Dichloropropene	< 1.0	1027
trans-1,3-Dichloropropene	< 10	10.00
1,1,2-Trichloroethane	< 1.0	10.46
Tetrachloroethene (PCE)	< 10	t o ag l
Dibromochloromethane	< 1 ()	$1.0~\mu g$ l
Chiarobenzene	< 1.0	1.0 (0)
Bromoform	< 10	y o agr
1,1,2,2-Tetrachloroethane	< 10	* 0 ag !
1,3-Dichlorobenzene	< 1 ()	* () 1, q (
1,4-Dichlorobenzene	< 1.0	$(\mathfrak{O}_{\mathfrak{p}},\mathfrak{q})$
1,2-Dichlorobenzene	< ' ()	· (*,)

Units:

1.	μg/l	Micrograms per liter (parts per	billion)
	5.54		

Signed / John Sung Analyst - Peter Guy

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P20
Date Sampled: 12/13/97
Date Analyzed: 12/14/97

Sample: 39 of 48 Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	_
Benzene	< 2.00	2.00 μg/l	-
Toluene	< 2.00	2.00 นุญไ	-
Ethylbenzene	< 2.00	2.00 µg/l	<u>.</u>
Xylenes (o,m,p)	< 6.00	6.00 μg/l	1
Naphthalene	< 2.00	2.00 µg/l	
TPH (DRO)	1.68	0.50 mg/l²	-

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

 1 µg/l Micrograms per liter (parts per billion).

mg/l Milligrams per liter (parts per million).

Signed__

Peter T. Guy

		~

Client/Site: Golder Assoc./MARCO Refinery

P20-S-1 Sample ID: 12/13/97 Date Sampled: 12/14/97 Date Analyzed:

Sample: 40 of 48 Method EPA 8021

Matrix: Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 5.0	5 O ng kg
Chloromethane	< 50	5 O p.g.kg
Vinyl chloride	< 50	5.0 ng kg
Bromomethane	< 50	5.0 ng kg
Chloroethane	< 5 ()	$\mathbb{P}[0]_{H}\mathcal{R}g$
Trichlorofluoromethane	< 5.0	7 O jog kg
1,1-Dichloroethene	< 5.0	5 0 ay kg
Methylene chloride	< 5.0	$5.0\mu\mathrm{gkg}$
trans-1,2-Dichloroethene	< 50	5.0 µg/kg
1,1-Dichloroethane	< 50	5.0 p.g.kg
Chloroform	< 50	5 O jog kg
1,1,1-Trichloroethane	< 50	ં ડે , દ્વ ેલુ
Carbon tetrachloride	< 5 ()	\mathbb{T}_{-1} (see Fig.
1,2-Dichloroethane	< 50	3 Cagby
Trichloroethene (TCE)	< 5.0	5.0 ngkg
1,2-Dichloropropane	< 5 ()	5.0 ag/kg
Bromodichloromethane	< 50	$5.0 \log kg$
cis-1,3-Dichloropropene	< 5.0	$5.0~\mu g \log$
trans-1,3-Dichloropropene	< 50	24.90 C
1,1,2-Trichloroethane	< 50	$\pi \circ a \circ k g$
Tetrachioroethene (PCE)	< 50	7 O yeş ke
Dibromochloromethane	< 5 0	7.00 ng kg
Chlorobenzene	< 50	*O mykg
Bromoform	< 50	7.0 pg kg
1,1,2,2-Tetrachloroethane	< 5.0	50 ng kg
1,3-Dichlorobenzene	< 5.0	5 O righg
1,4-Dichlorobenzene	< 5.0	5 o rag kg
1,2-Dichlorobenzene	< 50	5.5 Lot Kit

Units:

1. μg/kg Micrograms per kilogram (parts per billion).

Signed Analyst - Peter Guy

Client/Site: Golder Assoc./MARCO Refinery Sample: 40 of 48

 Sample ID:
 P20-S-1
 Method: EPA 8021/OA-2

 Date Sampled:
 12/13/97
 Matrix: Soil

Date Analyzed: 12/14/97

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 μg/kg	<u>-</u>
Toluene	< 10.0	10.0 µg/kg	<u> </u>
Ethylbenzene	< 10.0	10.0 μg/kg	<u>-</u>
Xylenes (o,m,p)	< 30.0	30.0 µg/kg	1
Naphthalene	< 10.0	10.0 µg/kg	-
TPH (DRO)	243	1.00 mg/kg ⁻	

Key to Flags

1. Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

1 μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

Peter T. Guy

Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled: P15-S-1 12/13/97

Date Sampled: 12/13/97

Date Analyzed: 12/14/97

Sample: 41 of 48 Method: EPA 8021

Matrix, Soil

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 5.0	igsiga 0 č
Chloromethane	< 5.0	5 to nackg
Vinyl chloride	< 50	$5.0 \mathrm{agkg}$
Bromomethane	< 5.0	5 O ag kg
Chloroethane	< 50	5 (1 sig + g
Trichlorofluoromethane	< 5.0	5 O pg kg
1,1-Dichloroethene	< 50	5.0 ng kg
Methylene chloride	< 5.0	7.0 ng kg
trans-1,2-Dichloroethene	< 50	5 0 ng kg
1,1-Dichloroethane	< 5.0	5.0 ngAg
Chiorotorm	< 50	5 U ng kg
1,1,1-Trichioroethane	< 5.0	5 O de ke
Carbon tetrachloride	< 5.0	Story of Kit
1,2-Dichloroethane	< 5.0	5 congiky
Trichloroethene (TCE)	< 5.0	5 о ад кр
1,2-Dichloropropane	< 50	5 o an kg
Bromodichloromethane	< 50	5.0 ug kg
cis-1,3-Dichloropropene	< 50	5 et ag kg
trans-1,3-Dichloropropene	< 5.0	10 ng kg
1,1,2-Trichloroethane	< 5 ()	$5.0 \log kg$
Tetrachloroethene (PCE)	< 50	5 o ng kg
Dibromochloromethane	< 5 ()	Totag kg
Chiorobenzene	< 50	7 (1 of 8 of
Bromotorm	< 50	5 Clary kg
1,1,2,2-Tetrachloroethane	< 5.0	$\mathbb{R}[Q]_{0}(Q,k Q)$
1,3-Dichlorobenzene	< 5 ()	5.0 ag kg
1,4-Dichlorobenzene	< 5.0	70 (1) (1)
1,2-Dichlorobenzene	< 50	S. O. Corpling

U	\mathbf{r}	1 7	c	
\sim	1 1	11		

1. μg/kg

Micrograms per kilogram (parts per billion).

Signed Adary
Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P15-S-1 Date Sampled: 12/13/97 Date Analyzed: 12/14/97 Sample: 41 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	-
Benzene	< 10.0	10.0 μg/kg	-
Toluene	< 10.0	10.0 μg/kg	•
Ethylbenzene	< 10.0	10.0 μg/kg	•
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	1
Naphthalene	< 10.0	10.0 μg/kg	<u> </u>
TPH (DRO)	< 1.00	1.00 mg/kg ²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Date Sampled:

Sample: 42 of 48 Method: EPA 8021 Matrix: Water

12/13/97 Date Analyzed: 12/14/97

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 10	1 0 ng//
Chloromethane	< 10	1 O ng i
Vinyl chloride	< 10	10 net
Bromomethane	< 10	1 0 ag 1
Chloroethane	< 1.0	1.0 ag i
Trichlorofluoromethane	< 1.0	1.0 ng/1
1,1-Dichloroethene	< 1.0	1 0 ngT
Methylene chloride	< 1.0	10,104
trans-1,2-Dichloroethene	< 1.0	10 mg l
1,1-Dichloroethane	< 10	Fga 0.1
Chloroform	< 1.0	
		10,481
1,1,1-Trichloroethane	< 1.0	1.0 p.e.T
Carbon tetrachloride	<. 1 O	1 GgT
1,2-Dichloroethane	< 1.0	f g _o g 0 i
Trichloroethene (TCE)	< 1.0	1-C ₁ , 1 ₂ , 1
1,2-Dichloropropane	< 10	1.0 μ.g.1
Bromodichloromethane	< 1.0	2.0 mg/l
cis-1,3-Dichloropropene	< 1.0	t ting!
trans-1,3-Dichloropropene	< 10	1 (0), gT
1,1,2-Trichloroethane	< 1 0	1 (egg)
Tetrachloroethene (PCE)	< 10	1 (1.ig/l
Dibromochloromethane	< 1.0	1.0 , (g. 1
Chlorobenzene	< 1.0	1.92,49.1
Bromoform	< 10	1 0 ng l
1,1,2,2-Tetrachforoethane	< 10	* O ng (
1,3-Dichlorobenzene	< 10	* 0.45K c
1,4-Dichlorobenzene	< 10	The A. W. C.
1,2-Dichlorobenzene	< 1.0	2.1 492.1

Units:

1. μg/l

Micrograms per liter (parts per billion).

Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

Date Analyzed: 12/14/97

M3

Date Sampled: 12/13/97

Sample: 42 of 48

Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	2.00 μg/l¹	-
Benzene	< 2.00	2.00 µg/l	-
Toluene	< 2.00	2.00 μg/l	<u>-</u>
Ethylbenzene	< 2.00	2.00 µg/l	<u> </u>
Xylenes (o,m,p)	< 6.00	6.00 µg/l	1
Naphthalene	< 2.00	2.00 μg/l	·
TPH (DRO)	< 0.50	0.50 mg/l²	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes.

Unit Conversions:

Micrograms per liter (parts per billion). μg/l

mg/l Milligrams per liter (parts per million).

Client/Site: Golder Assoc/MARCO Refinery

Sample ID: Barrel 1
Date Sampled: 12/11/97
Date Analyzed: 12/11/97

Sample: 43 of 48 Method, EPA 8021 Matrix - Water

Analyte	Concentration	Detection Limit
Dichlorodifluoromethane	< 10	1 0 ag i
Chloromethane	< 1.0	1 () ,ag T
Vinyl chloride	< 10	1 () pg 1
Bromomethane	< 10	$r_{g,i} \circ r$
Chloroethane	< 10	* (C) (1, 12, 1)
Trichlorotluoromethane	< 1.0	1.0 ((4))
1,1-Dichloroethene	< 10	10 mg!
Methylene chloride	< 10	1.0 ng/1
trans-1,2-Dichloroethene	< 1 ()	10.03
1,1-Dichloroethane	< 10	1 0 µgT
Chloroform	17.4	1.0 641
1,1,1-Trichloroethane	< 1.0	* Ang l
Carbon tetrachloride	< 1.0	2.0
1,2-Dichloroethane	< 10	1044
Trichloroetnene (TCE)	< 10	3 O agr
1,2-Dichloropropane	< 1 ()	T.O. ag.
Bromodichloromethane	< 1 ()	1.0 ,031
cis-1,3-Dichloropropene	< 10	1.0g l
trans-1,3-Dichloropropene	< 10	* 0 ag.!
1,1,2-Trichloroethane	< 1.0	100.001
Tetrachloroethene (PCE)	< 1.0	for agr
Dibromochloromethane	< 10	1 0 ag1
Chiorobenzene	< 10	* (0g.)
Bromotorm	< 10	" U Let
1,1,2,2-Tetrachloroethane	< 1.0	luagi
1,3-Dichlorobenzene	< 10	10.001
1,4-Dichlorobenzene	< 10	to og (
1,2-Dichlorobenzene	< 1 ()	10,00

Units:

1.	μg/l	Micrograms per liter (parts per l	billion).
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Signed Adustry
Analyst - Peter Guy



Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

Barrel 1 Date Sampled: 12/11/97 Date Analyzed: 12/11/97 Sample: 43 of 48

Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MiBE	< 2.00	2.00 μg/T	-
Benzene	< 2.00	2.00 µg/l	-
Toluene	< 2.00	2.00 μg/l	<u>-</u>
Ethylbenzene	< 2.00	2.00 µg/l	<u> </u>
Xylenes (o,m,p)	< 6.00	6.00 µg/l	1
Naphthalene	< 2.00	2.00 µg/l	<u>-</u>
TPH (DRO)	< 0.50	0.50 mg/l²	<u>-</u>

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

Micrograms per liter (parts per billion). μg/l

Milligrams per liter (parts per million). mg/l

Signed Adarbury Peter T. Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID: Barrel 2
Date Sampled: 12/12/97
Date Analyzed: 12/12/97

Sample, 44 of 48 Method: EPA 8021 Matrix - Water

Analyte	Concentration	Detection Limit
Dic hlorodifluoromethane	< 1 ()	1.0 ag.:
Chloromethane	< 1.0	1.0 (4)
Vinyl chloride	< 1.0	
Bromomethane	< 1.0	10 ag
		1.0 ag :
Chloroethane	< 1.0) 11
Trichlorofluoromethane	< 10	1.0 ag.)
1,1-Dichloroethene	< 10	1 (Fig.)
Methylene chloride	< 1.0	1.0 ((g))
trans-1,2-Dichloroethene	< 1.0	1.0 ag 1
1,1-Dichloroethane	< 10	Fg., 0 f
Chloroform	8 65	Tg., U *
1,1,1-Trichioroethane	< 1.0	* O sign
Carbon tetrachloride	< 1.0	$(y_{ij},0)^{*}$
1,2-Dichioroethane	< 1.0	(0, y)
Trichloroethene (TCE)	< 1.0	10g1
1,2-Dichloropropane	< 10	7 g., g7
Bromodichloromethane	< 1.0	1 (C 1)(C 1)
cis-1,3-Dichloropropene	< 1.0	Fgg, O
trans-1,3-Dichloropropene	< 1 ()	1 O agT
1,1,2-Trichloroethane	< 10	To agt
Tetrachloroethene (PCE)	< 10	COLVE!
Dibromochloromethane	< 1 ()	* Olag
Chlorobenzene	< 10	1.0 444
Bromotorm	< 10	1000
1,1,2,2-Tetrachloroethane	< 10	1.0;
1,3-Dichlorobenzene	< 10	* Ourg
1,4-Dichlorobenzene	< 10	* C 4.9.*
1,2-Dichlorobenzene	< 1.0	1.49

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1. μg/l

Micrograms per liter (parts per billion).

Signed Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

Barrel 2 Date Sampled: 12/12/97 Date Analyzed: 12/12/97 Sample: 44 of 48

Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MIBE	< 2.00	2.00 μg/l'	-
Benzene	< 2.00	2.00 μg/l	
Toluene	6.40	2.00 μg/l	<u>-</u>
Ethylbenzene	< 2.00	2.00 μg/Ι	<u> </u>
Xylenes (o,m,p)	< 6.00	6.00 µg/l	11
Naphthalene	< 2.00	2.00 μg/]	
TPH (DRO)	< 0.50	0.50 mg/l ⁻	-

Key to Flags

Detection limit is for the sum of the three (3) xylenes. 1.

Unit Conversions:

Micrograms per liter (parts per billion). $\mu g/\Gamma$

mg/l Milligrams per liter (parts per million).

Signed_____ Peter T. Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P18 duplicate

Date Sampled: Date Analyzed: 12/9/97

12/9/97

Sample: 45 or 48 Method, EPA 8021

Matrix: Water

Analyte	Concentration	Detection Limit
Dichlorodeliuoromethane	< 1.0	? O agT
Chloromethane	< 10	10791
Vinyl chloride	< 10	1.0.,03
Bromomethane	< 10	1.0
Chloroethane	< 1.0	(p_{ij}, p_{ij})
Trichlorofluoromethane	< 1.0	1 tt ₄ .gT
1,1-Dichloroethene	< 1 ()	1.0 p.g.1
Methylene chloride	< 10	1.0%,43
trans-1,2-Dichloroethene	< 10	(0,g)
1,1-Dichlorcethane	< 10	1 0 agT
Chloroform	< 1.0	10
1,1,1-Trichloroethane	< 1.0	7.0 4.97
Carbon tetrachloride	< 1.0	1040
1,2-Dichloroethane	< 10	* \$ (1.4) ·
Frichloroethene (TCE)	< 1.0	(x,y,y)
1,2-Dichloropropane	< 10	1.0 μg :
Bromodichloromethane	< 10	1 0 , cg T
cis-1,3-Dichloropropene	< 1.0	f. (0) ag (1)
trans-1,3-Dichloropropene	< 10	1091
1,1,2-Trichloroethane	< 1 ()	f(m,0)
Tetrachioroethene (PCE)	< 1 ()	* (0 p.g.)
Dibromochloromethane	< 1.0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Chlorobenzene	< 10	to ag!
Bromotorm	< 10	" No GALL
1,1,2,2-Tetrachlorcethane	< 10	Const
1,3-Dichlorobenzene	< 10	*C p.g.t
1,4-Dichlorobenzene	< 10	1 (1,10)
1,2-Dichlorobenzene	< : 0	1.0 , , g (

U	n		c	
U		11	- >	

1. μg/l Micrograms per liter (parts per billion).

Signed 7de Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P18 duplicate

Date Sampled: 12/9/97 Date Analyzed: 12/9/97 Sample: 45 of 48

Method: EPA 8021/OA-2

Matrix: Water

Analyte	Concentration	Detection Limit	Flag
MtBE	< 2.00	ا/پوپر 2.00	-
Benzene	< 2.00	2.00 μg/l	-
Toluene	< 2.00	2.00 µg/l	<u> </u>
Ethylbenzene	< 2.00	2.00 μα/Ι	-
Xylenes (o,m,p)	< 6.00	6.00 μα/l	1
Naphthalene	< 2.00	2.00 µg/l	-
TPH (DRO)	< 0.50	0.50 mg/l ²	2

Key to Flags

- 1. Detection limit is for the sum of the three (3) xylenes.
- 2. Parameter not measured in this sample.

Unit Conversions:

 1 µg/l Micrograms per liter (parts per billion).

² mg/l Milligrams per liter (parts per million).

Signed_

Peter T. Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P6-S-1 duplicate

Date Sampled: Date Analyzed: 12/13/97 12/13/97 Sample: 46 of 48 Method: EPA 8021

Matrix, Soil

Analyte	Concentration	Detection Limit
Dichloroditluoromethane	< 5.0	5 () ag kg
Chloromethane	< 5.0	5.0 pg/kg
Vinyl chloride	< 5.0	5 () 11g/kg
Bromomethane	< 50	5.0 ngkg
Chloroethane	< 5 ()	5.0 mg kg
Trichlorofluoromethane	< 50	5 O ng kg
1,1-Dichloroethene	< 5.0	5.0 ng/kg
Methylene chloride	< 50	$5.0 \mathrm{kg} \mathrm{kg}$
trans-1,2-Dichloroethene	< 5.0	5.0 geglag
1,1-Dichloroethane	< 5.0	5.0 µg/kg
Chloroform	< 50	5.0 ng/kg
1,1,1-Trichloroethane	< 5.0	5 O agakg
Carbon tetrachloride	< 5.0	$5.0 \mu g \kappa g$
1,2-Dichloroethane	< 5.0	$5.0 \mu g \star g$
Trichloroethene (TCE)	< 50	5 0 руку
1,2-Dichloropropane	< 5.0	$5.0 \mu \mathrm{g.kg}$
Bromodichloromethane	< 5.0	5 0 ag/kg
cis-1,3-Dichlaropropene	< 50	5.0 ng/kg
trans-1,3-Dichloropropene	< 50	5 O ng kg
1,1,2-Trichloroethane	< 50	5 O mg/kg
Tetrachloroethene (PCE)	< 50	5.0 ng kg
Dibromochloromethane	< 5.0	5 Cing kg
Chiorobenzene	< 5.0	5.0 pg kg
Bromotorm	< 50	of the second
1,1,2,2-Tetrachloroethane	< 5.0	5 c s.q.kg
1,3-Dichlorobenzene	< 5 ()	7 O ng kg
1,4-Dichlorobenzene	< 5.0	5 О ид ка
1,2-Dichlorobenzene	< 5.0	5 Ulug kg

U	n	ŀ	ţ	S	:

1. μg/kg Micrograms per kilogram (parts per billion).

Analyst - Peter Guy

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Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P6-S-1 duplicate

Date Sampled: 12/13/97 Date Analyzed: 12/13/97

Sample: 46 of 48 Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MiBE	< 10.0	10.0 μg/kg¹	•
Benzene	< 10.0	10.0 µg/kg	<u>-</u>
Toluene	< 10.0	10.0 μg/kg	<u>-</u>
Ethylbenzene	< 10.0	10.0 μg/kg	
Xylenes (o,m,p)	< 30.0	30.0 µg/kg	1
Naphthalene	< 10.0	10.0 μg/kg	-
TPH (DRO)	< 1.00	1.00 mg/kg²	2

Key to Flags

- 1. Detection limit is for the sum of the three (3) xylenes.
- 2. Parameter not measured in this sample.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

Signed Folgony Peter T. Guy //

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Client/Site: Golder Assoc./MARCO Refinery

Sample ID: P15-S-1 duplicate

Date Sampled: 12/13/97 Date Analyzed: 12/14/97 Sample: 47 of 48

Method: EPA 8021 'OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	2
Benzene	< 10.0	10.0 µg/kg	2
Toluene	< 10.0	10.0 µg/kg	2
Ethylbenzene	< 10.0	10.0 μg/kg	2
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	1.2
Naphthalene	< 10.0	10.0 µg/kg	2
TPH (DRO)	< 1.00	1.00 mg/kg-	-

Key to Flags

- 1. Detection limit is for the sum of the three (3) xylenes.
- 2. Parameter not measured in this sample.

Unit Conversions:

1 μg/kg Micrograms per kilogram (parts per billion).

² mg/kg Milligrams per kilogram (parts per million).

D. T. C.

Peter I. Guy

Client/Site:

Golder Assoc./MARCO Refinery

Sample ID:

P5-S-1 duplicate

Date Sampled: 12/13/97 Date Analyzed: 12/14/97

Sample: 48 of 48

Method: EPA 8021/OA-2

Matrix: Soil

Analyte	Concentration	Detection Limit	Flag
MtBE	< 10.0	10.0 μg/kg¹	2
Benzene	< 10.0	10.0 μg/kg	2
Toluene	< 10.0	10.0 µg/kg	2
Ethylbenzene	< 10.0	10.0 μg/kg	2
Xylenes (o,m,p)	< 30.0	30.0 μg/kg	1,2
Naphthalene	< 10.0	10.0 µg/kg	2
TPH (DRO)	< 1.00	1.00 mg/kg²	

Key to Flags

- 1. Detection limit is for the sum of the three (3) xylenes.
- 2. Parameter not measured in this sample.

Unit Conversions:

μg/kg Micrograms per kilogram (parts per billion).

mg/kg Milligrams per kilogram (parts per million).

Signed Four Peter T. Guy

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Page ____ of ____

Project Name: MARCO Refinery Project Number: 97-66-118 Project Site: Chanute KS Contact Person: Mike				No. of Conta	keay	es Request		•//	
Sample ID	Date	Time	Matrix (S/W/A)	S					Notes:
PIO-5-1 7.5'	12-9-97		5	1	X	X			
P18-5-1 3.0'			5	1	×	X			
3 P-18-W-1		16:40	W		Х	X			
P-9-5-1 1.5'	12-10-97	8:37	S	1	X	X			
PR-5-1 2.0'	1	9:55	5	1	X	X			
(18-6)-1		10:31	w		λ	χ			
⁷ P7-5-1 1.5'		11:17	S	1	χ	X	-		
* P-7		3 20	w	2	X	X			
° pq		3:2/5	w	2	Х	X			
10 PII-5-1	(16:40	S		X	X			
11 - ΡΠ	12-11-97	900	W	2	χ	X			
12 (1)		9:30	w	2	Х	X			
13 P12-5-1		1445	5		χ	X			
14 የነጋ	\	1445	W	2	X	X			
15									
16									

Relinquished by:	Date:	Time:	Received by:
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Page Q of 3

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Project Name: Macos Ref	S. O. P. S. U.			No.						
Project Number: 97-66-11 \$	2			of				/ /	/ /	7//
Project Site: Chande K				C o n		aves!	<i>b</i> /	/ ,	/ /	////
•	·			t a	,,,	Se Heline	3/0	}/		
Contact Person: Mike				i	Aria)	se Recuest	3)	//		
			T	e r s	 	/_		/	/	
Sample ID	Date	Time	Matrix (S/W/A)	,		_				Notes:
, P17	13-11-97	1730	3	a	X	X				
² P19)	1730	W	7	X	X				
3 1219-5-1 3.5'		1730	5	l	Χ	X				
P17-5-1		1730	5		X	大				
5 P14	12-13-97	1040	ω	(\$	X	X				
6 P16		1400	12	رم	X	X				
7 Pi6-5-1 3'		CCFI	\$	1	Х	X				
8 83-5-1 35'		1700	5	1	X	X				
9		1800	w	__	X	X				
10 P2		1830	$\langle \chi \rangle$	2	\times	X				
11 P14-5-1		1030	5	_];	X	X				
12 86-5-1 7.3'	12-13-97	0840	S	ļ	Χ	X				
¹³ የር		6900	W	4	X	\times				
14 P4-5-1 3.8°		1010	5	1	X	X				
15 P4		1300	ω	7	>	\times				
16 PS		1300	3 W	9	X	X				

Relinquished by:	Date:	Time:	Received by:
			1 th Com
			(



Fax (785) 542-3971

Project Name: Marco Refinery Project Number: 97-66-118 Project Site: Character KS Contact Person: MKe					kralf	e Regles!		
Sample ID	Date	Time	Matrix (S/W/A)	r S				Notes:
1 P5-5-1 10.9'	12-13-97	1350	5	١	X	X		
2 73	12-17-97		W	ب	X	Χ		
3 P3-5-1	12-13-57	1545	5		Х	×		
P.15	7-13-97	1600	12	2	χ	X		
5 M-4/		1800	(4)	2	X	X		
6 M.3 7 P.3			い	2	Χ	X		
		,	(L)	2	X	X		
8 P1351			5	1	X	X		
9 P2C			اربر	2	X	X		
10 6/20 5-1			5	1	X	X		
" P15-5-1			Ú)	1	X	X		
12			W	3	X	X		
13						,		
14								
15								
16								

Relinquished by:	Date:	Time:	Received by:
		-	18th 6-

APPENDIX I PACE ANALYTICAL RESULTS

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Tel 913-599-5665 Fax: 913-599-1759

RECEIVED

JAN - 2 1998

GOLDER ASSOCIATES

Mr. RANDY MARCH GOLDER ASSOCIATES INC 200 UNION BOULEVARD SUITE 500 LAKEWOOD. CO 80228

December 29, 1997

RE: Pace Project Number: 6019010

Client Project ID: Marco, KS

Dear Mr. MARCH:

Enclosed are the results of analyses for sample(s) received on December 14, 1997. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Mark Gudnason Project Manager

Enclosures

Tel 913-599-5665 Fax 913-599-1759

DATE: 12/29/97

PAGE: 1

GOLDER ASSOCIATES INC 200 UNION BOULEVARD

SUITE 500

LAKEWOOD. CO 80228

Pace Project Number: 6019010 Client Project ID: Marco, KS

Attn: Mr. RANDY MARCH Phone: (303)980-0540

Solid results are reported on a wet weight basis

Pace Sample No:

601638414

Date Collected:

12/10/97

Matrix: Soil

Client Sample ID:

P18-S-1D

Date Received:

12/14/97

Footnotes

.....

Parameters

Results

Units

PRL

Analyzed Analyst CAS#

rootnotes

GC ·· Volatiles

Halogen. & Aromatic Vol. Orgs.	ŀ	Method: EPA 8021			Prep	Method: 5030 Med Lvl Soil
iloromethane	400	ug/kg	20	12/24/97	WCM	74 - 87 - 3
inyl Chloride	ND	ug/kg	45	12/24/97	MUM	75-01-4
Bromomethane	ND	ug/kg	75	12/24/97	MJW	74-83-9
Chloroethane	ND	ug/kg	130	12/24/97	MJW	75-00-3
Trichlorofluoromethane	ND	ug/kg	120	12/24/97	MUM	75-69-4
1,1-Dichloroethene	ND	ug/kg	34	12/24/97	MJW	75-35-4
Methylene Chloride	ND	ug/kg	63	12/24/97	MUM	75-09-2
trans-1,2-Dichloroethene	ND	ug/kg	26	12/24/97	MUM	156-60-5
1.1-Dichloroethane	ND	ug/kg	18	12/24/97	MUM	75 - 34 - 3
Chloroform	ND	ug/kg	13	12/24/97	WLM	67 · 66 · 3
1.1.1 Trichloroethane	ND	ug/kg	13	12/24/97	MJW	71-55-6
Carbon Tetrachloride	ND	ug/kg	30	12/24/97	MUM	56-23-5
Benzene	ND	ug/kg	49	12/24/97	WCM	71-43-2
1.2-Dichloroethane	ND	ug/kg	13	12/24/97	MJW	107-06-2
cis-1.3-Dichloropropene	ND	ug/kg	85	12/24/97	MUM	10061 - 01 - 5
Trichloroethene	ND	ug/kg	30	12/24/97	MJW	79-01-6
1.2-Dichloropropane	ND	ug/kg	13	12/24/97	MJW	78-87-5
Bromodichloromethane	ND	ug/kg	26	12/24/97	MJW	75-27-4
Toluene	ND	ug/kg	49	12/24/97	MJW	108-88-3
1.1.2 Trichloroethane	ND	ug/kg	13	12/24/97	MJW	79 - 00 - 5
trans-1.3-Dichloropropene	ND	ug/kg	15	12/24/97	MJW	10061-02-6
Tetrachloroethene	ND	ug/kg	13	12/24/97	MUM	127-18-4
Dibromochloromethane	ND	ug/kg	24	12/24/97	WLM	124-48-1
Chlorobenzene	ND	ug/kg	17	12/24/97	MJW	108-90-7
Ethylbenzene	ND	ug/k g	49	12/24/97	MJW	100-41-4
^nomoform	ND	ug/kg	49	12/24/97	MJW	75-25-2

REPORT OF LABORATORY ANALYSIS

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Tel 913-599-5665 Fax 913-599-1759

DATE: 12/29/97

PAGE: 2

Pace Sample No: 6	01638414		Date Colle	cted: 12	2/10/97		Matrix: Soil
Client Sample ID: P	18-S-1D		Date Rece	ived: 12	2/14/97		
Parameters	Results	Units	PRL	Analyzed	Analy	st CAS#	Footnotes
1.1.2.2-Tetrachloroe	thane ND	ug/kg	13	12/24/97	MJW	79-34-5	
Xylene (Total)	ND	ug/kg	170	12/24/97	WLM	1330-20-7	
1.3-Dichlorobenzene	ND	ug/kg	26	12/24/97	MUM	541-73-1	
1.4-Dichlorobenzene	ND	ug/kg	26	12/24/97	MJW	106-46-7	
1.2 Dichlorobenzene	ND	ug/kg	26	12/24/97		95-50-1	
Naphthalene	ND	ug/kg	120	12/24/97		91 - 20 - 3	
Methyl-tert-butyl Et		ug/kg	260	12/24/97	MJW	1634 - 04 - 4	
Dichlorodifluorometh		ug/kg	69	12/24/97	MJW	75-71-8	
a,a,a-Trifluorotolue	ne (S) 84	*		12/24/97	MJW	2164-17-2	
1.4-Dichlorobutane (• •	İ		12/24/97	WCM	110-56-5	
GC Semi-VOA							
Thtal Extractable Hydro	ocarbons Me	thod: OA2			Prep	Method: 0A2	
ineral Spirits	ND	mg/kg	9.9	12/20/97	EMA		
Jet Fuel	ND	mg/kg	9.9	12/20/97	EMA		
Kerosene	ND	mg/kg	9.9	12/20/97	EMA		
Diesel Fuel	ND	mg/kg	9.9	12/20/97	EMA	11-84-7	
Fuel Oil	ND	mg/kg	9.9	12/20/97	EMA		
Motor Oil	ND	mg/kg	9.9	12/20/97	EMA		
n-Tetracosane (S)	92	*		12/20/97	EMA	646-31-1	
p-Terphenyl (S)	95	*		12/20/97	EMA	92 - 94 - 4	
Date Extracted				12/18/97			

		<u> </u>

DATE: 12/29/97

PAGE: 3

Pace Project Number: 6019010 Client Project ID: Marco, KS

Pace Sample No: 601638455 Date Collected: 12/10/97 Matrix: Water 12/14/97 Client Sample ID: P18-W-1D Date Received: Parameters Results Units PRL Analyzed Analyst CAS# Footnotes GC -- Volatiles Halogen. & Aromatic Vol. Orgs. Method: EPA 8021 Prep Method: EPA 8021 Chloromethane ND ug/L 0.8 12/20/97 MJW 74-87-3 ND 75-01-4 Vinyl Chloride ug/L 12/20/97 M. IV 1.8 74-83-9 Bromomethane ND ug/L 3 12/20/97 MJH ND 5.2 12/20/97 MUM 75-00-3 Chloroethane ug/L 75-69-4 Trichlorofluoromethane ND ug/L 12/20/97 M.TU 1.1-Dichloroethene ND ug/L 1.3 12/20/97 MJW 75-35-4 Methylene Chloride ND ug/L 2.5 12/20/97 MJW 75-09-2 156-60-5 trans-1,2-Dichloroethene ND ug/L 1 12/20/97 MJW 1.1-Dichloroethane 12/20/97 MJW 75-34-3 ND ug/L 0.7 Chloroform ND ug/L 0.5 12/20/97 MUM 67-66-3 1.1-Trichloroethane ND ug/L 0.5 12/20/97 MJW 71-55-6 carbon Tetrachloride ND ug/L 1.2 12/20/97 MJW 56-23-5 12/20/97 MUM 71-43-2 Benzene ND ug/L 2 1.2-Dichloroethane ND ug/L 0.5 12/20/97 MUM 107-06-2 cis-1,3-Dichloropropene ug/L 10061-01-5 ND 3.4 12/20/97 M.JW Trichloroethene ND ug/L 1.2 12/20/97 79-01-6 1,2-Dichloropropane ND ug/L 0.5 12/20/97 MIL 78-87-5 75-27-4 Bromodichloromethane ND ug/L 1 12/20/97 M. IW 108-88-3 ND ug/L 12/20/97 Toluene 2 MCM 79-00-5 1.1.2 · Trichloroethane ND ug/L 0.5 12/20/97 MJW trans-1.3-Dichloropropene ND ug/L 0.6 12/20/97 MJW 10061-02-6 Tetrachloroethene ND ua/L 0.5 12/20/97 MJW 127-18-4 Dibromochloromethane ND ug/L 0.9 12/20/97 MUM 124-48-1 Chlorobenzene ND ug/L 0.7 12/20/97 MJW 108-90-7 ND Ethylbenzene ug/L 2 12/20/97 MJW 100-41-4 Bromoform ND ug/L 2 12/20/97 MUM 75-25-2 1.1.2.2-Tetrachloroethane ND ug/L 0.5 12/20/97 MJW 79-34-5 Xylene (Total) ND ug/L 7 12/20/97 M 1U 1330-20-7 1,3-Dichlorobenzene ND ug/L 1 12/20/97 541-73-1 ug/L 1.4-Dichlorobenzene ND 106-46-7 1 12/20/97 MJW 1.2-Dichlorobenzene ND ug/L 1 95-50-1 12/20/97 MJW Naphthalene ND ug/L 5 91-20-3 12/20/97 MJW Methyl-tert-butyl Ether 1634-04-4 ND ug/L 10 12/20/97 Dichlorodifluoromethane ND ug/L 5 12/20/97 MJW 75 - 71 - 8

GC -- Semi-VOA

a.a.a-Trifluorotoluene (S)

4-Dichlorobutane (S)

93

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REPORT OF LABORATORY ANALYSIS

12/20/97

12/20/97 MJW

M.N.

2164 - 17 - 2

110-56-5

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Tel 913-599-5665 Fax 913-599-1759

DATE: 12/29/97

PAGE: 4

Pace Sample No:	601638455					/10/97		Matrix: Water
Client Sample ID:	P18-W-1D			Date R	eceived: 12	/14/97		
Parameters		Results	Units	PRL	Analyzed	Analys	t CAS#	Footnotes
Total Extractable (Hydrocarbons	Meth	od: 0 A2	• •••••		Prep M	lethod: OA2	
Mineral Spirits		ND	mg/L	0.4	12/19/97	EMA		
Jet Fuel		ND	mg/L	0.4	12/19/97	EMA		
Kerosene		ND	mg/L	0.4	12/19/97	EMA		
Diesel Fuel		ND	mg/L	0.4	12/19/97	EMA	11-84-7	•
Fuel Oil		ND	mg/L	0.4	12/19/97	EMA		
Motor Oil		ND	mg/L	0.4	12/19/97	EMA		
p-Terphenyl (S)		93	*		12/19/97	EMA	92-94-4	
n-Tetracosane (S))	87	*		12/19/97	EMA	646-31-1	
Date Extracted					12/17/97			

		_

DATE: 12/29/97

PAGE: 5

Pace Project Number: 6019010 Client Project ID: Marco, KS

Date Collected: 12/10/97 Pace Sample No: 601638463 Matrix: Water

Client Sample ID: TRIP BLANK Date Received: 12/14/97

Results Units PRL Analyzed Analyst CAS# Parameters Footnotes

GC

alogen. & Aromatic Vol. Orgs.	Me	ethod: EPA 80	21		Prep	Method: EPA 8021
Chloromethane	ND	ug/L	8.0	12/21/97	MCM	74 - 87 - 3
Vinyl Chloride	ND	ug/L	1.8	12/21/97	MCM	75-01-4
Bromomethane	ND	ug/L	3	12/21/97	MCM	74-83-9
Chloroethane	ND	ug/L	5.2	12/21/97	MJW	75-00-3
Trichlorofluoromethane	ND	ug/L	5	12/21/97	MJW	75-69-4
1.1-Dichloroethene	ND	ug/L	1.3	12/21/97	WCM	75 - 35 - 4
Methylene Chloride	ND	ug/L	2.5	12/21/97	WCM	75-09-2
trans-1,2-Dichloroethene	ND	ug/L	1	12/21/97	WCM	156-60-5
1.1-Dichloroethane	ND	ug/L	0.7	12/21/97	MUM	75 - 34 - 3
Chloroform	ND	ug/L	0.5	12/21/97	MJW	67 - 66 - 3
1.1-Trichloroethane	ND	ug/L	0.5	12/21/97	MJW	71-55-6
arbon Tetrachloride	ND	ug/L	1.2	12/21/97	MJW	56 - 23 - 5
Benzene	ND	ug/L	2	12/21/97	MJW	71 - 43 - 2
1.2-Dichloroethane	ND	ug/L	0.5	12/21/97	MJW	107-06-2
cis-1,3-Dichloropropene	ND	ug/L	3.4	12/21/97	WCM	10061-01-5
Trichloroethene	ND	ug/L	1.2	12/21/97	WCM	79-01-6
1.2-Dichloropropane	ND	ug/L	0.5	12/21/97	MJW	78-87-5
Bromodichloromethane	ND	ug/L	1	12/21/97	WLM	75 - 27 - 4
Toluene	ND	ug/L	2	12/21/97	WLM	108-88-3
1.1.2-Trichloroethane	ND	ug/L	0.5	12/21/97	WCM	79-00-5
trans-1,3-Dichloropropene	ND	ug/L	0.6	12/21/97	WCM	10061-02-6
Tetrachloroethene	ND	ug/L	0.5	12/21/97	MUM	127-18-4
Dibromochloromethane	ND	ug/L	0.9	12/21/97	WCM	124-48-1
Chlorobenzene	ND	ug/L	0.7	12/21/97	WCM	108 - 90 - 7
Ethylbenzene	ND	ug/L	2	12/21/97	WCM	100-41-4
Bromoform	ND	ug/L	2	12/21/97	MUM	75-25-2
1.1.2.2-Tetrachloroethane	0.92	ug/L	0.5	12/21/97	MUM	79 - 34 - 5
Xylene (Total)	ND	ug/L	7	12/21/97	MJW	1330-20-7
1.3-Dichlorobenzene	ND	ug/L	1	12/21/97	MJW	541-73-1
1.4-Dichlorobenzene	ND	ug/L	1	12/21/97	MUM	106-46-7
1.2-Dichlorobenzene	ND	ug/L	1	12/21/97	WCM	95.50.1
Naphthalene	ND	ug/L	5	12/21/97	WCM	91 - 20 - 3
Methyl-tert-butyl Ether	ND	ug/L	10	12/21/97	WCM	1634 - 04 - 4
Dichlorodifluoromethane	ND	ug/L	5	12/21/97	MJW	75-71-8
a.a.a-Trifluorotoluene (S)	94	*		12/21/97	WLM	2164 - 17 - 2
4-Dichlorobutane (S)	96	1		12/21/97	WLM	110-56-5

REPORT OF LABORATORY ANALYSIS

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601638471

ND

ND

ND

ND

ND

ND

ND

ND

ND

ND

ND

87

102

ug/kg

ug/kg

ug/kg

ug/kg

ug/kg

ug/kg

ug/kg

ug/kg

ug/kg

ug/kg

ug/kg

18

50

50

13

180

26

26

26

130

260

70

12/24/97

12/24/97

12/24/97

12/24/97

12/24/97

12/24/97

12/24/97

12/24/97

12/24/97

12/24/97

12/24/97

12/24/97

12/24/97 MJW

MJW

MJW

M.IV

MJW

M.1M

MJW

MJW

MJW

M.1W

MJW

MJW

MJW

Pace Sample No:

Tel. 913-599-5665 Fax 913-599-1759

DATE: 12/29/97

PAGE: 6

Matrix: Soil

Pace Project Number: 6019010 Client Project ID: Marco, KS

108-90-7

100-41-4

75 - 25 - 2

79-34-5

1330-20-7

541-73-1

106-46-7

95.50.1

91-20-3

75-71-8

1634 - 04 - 4

2164-17-2

110 - 56 - 5

12/11/97

Date Received: Client Sample ID: P7-S-1D 12/14/97 Parameters Results Units **PRL** Analyzed Analyst CAS# Footnotes GC -- Volatiles Halogen. & Aromatic Vol. Orgs. Method: EPA 8021 Prep Method: 5030 Med Lvl Soil Chloromethane 440 ug/kg 20 12/24/97 MJW 74-87-3 Vinvl Chloride ND 46 12/24/97 75-01-4 M.JW ug/kg Bromomethane ND ug/kg 76 12/24/97 MJW 74-83-9 ND Chloroethane ug/kg 130 12/24/97 MJW 75-00-3 Trichlorofluoromethane ND 130 12/24/97 MCM 75-69-4 ug/kg 1.1-Dichloroethene ND ug/kg 34 12/24/97 WLM 75-35-4 ND 75-09-2 Methylene Chloride ug/kg 64 12/24/97 MUM trans-1.2 Dichloroethene ND 26 12/24/97 MJW 156-60-5 ug/kg 1.1-Dichloroethane 75-34-3 ND ug/kg 18 12/24/97 MJW MJW Chloroform ND ug/kg 13 12/24/97 67-66-3 1.1 Trichloroethane ND ug/kg 13 12/24/97 M.Ju 71-55-6 ND 56-23-5 carbon Tetrachloride ug/kg 30 12/24/97 MJW ND 50 12/24/97 71-43-2 Benzene ug/kg M.)W 1.2 Dichloroethane ND 13 12/24/97 MJW 107-06-2 ug/kg cis-1.3-Dichloropropene ND ug/kg 86 12/24/97 MJW 10061-01-5 79-01-6 Trichloroethene ND ug/kg 30 12/24/97 MJW 1.2-Dichloropropane ND 13 12/24/97 M.1U 78-87-5 ug/kg Bromodichloromethane ND ug/kg 26 12/24/97 M.)U 75-27-4 ND Toluene 50 12/24/97 M.IW 108-88-3 ug/kg 1.1.2-Trichloroethane ND 13 12/24/97 MUM 79-00-5 ug/kg trans-1.3-Dichloropropene ND ug/kg 15 12/24/97 M.IU 10061-02-6 Tetrachloroethene ND 13 12/24/97 127-18-4 ug/kg Dibromochloromethane 124 - 48 - 1 ND 24 ug/kg 12/24/97 MUM

Date Collected:

GC -- Semi-VOA

Chlorobenzene

Ethylbenzene

Xylene (Total)

Naphthalene

1.3-Dichlorobenzene

1.4-Dichlorobenzene

1.2-Dichlorobenzene

Methyl·tert·butyl Ether

Dichlorodifluoromethane

a.a.a.Trifluorotoluene (S)

4-Dichlorobutane (S)

1.1.2.2-Tetrachloroethane

Bromoform

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DATE: 12/29/97

PAGE: 7

Pace Sample No:	601638471			Date Co	llected: 12	/11/97		Matrix: Soil
Client Sample ID:	P7-S-1D			Date R	eceived: 12	/14/97		
Parameters		Results	Units	PRL	Analyzed	Analys	t CAS#	Footnotes
Total Extractable	Hydrocarbons	Meth	od: 0A2		• • • • • • • • • • • • • • • • • • • •	Prep M	ethod: OA2	
Mineral Spirits		ND	mg/kg	8.8	12/20/97	EMA		
Jet Fuel		ND	mg/kg	8.8	12/20/97	EMA		
Kerosene		ND	mg/kg	8.8	12/20/97	EMA		
Diesel Fuel		ND	mg/kg	8.8	12/20/97	EMA	11-84-7	
Fuel Oil		ND	mg/kg	8.8	12/20/97	EMA		
Motor 011		ND	mg/kg	8.8	12/20/97	EMA		
n-Tetracosane (S	5)	96	*		12/20/97	EMA	646-31-1	
p·Terphenyl (S)		103	*		12/20/97	EMA	92 - 94 - 4	
Date Extracted					12/19/97			

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Tel 913-599-5665 Fax. 913-599-1759

DATE: 12/29/97

PAGE: 8

Pace Project Number: 6019010 Client Project ID: Marco, KS

Pace Sample No:

601638489

Results Units

Date Collected:

12/11/97

Analyzed Analyst CAS#

Matrix: Water

Client Sample ID:

P7-W-1D

Date Received:

PRL

12/14/97

Footnotes

GC

Parameters

alogen. & Aromatic Vol. Orgs.	Me	thod: EPA 80	21		Prep	Method: EPA 802:
Chloromethane	ND	ug/L	0.8	12/21/97	WCM	74 - 87 - 3
Vinyl Chloride	ND	ug/L	1.8	12/21/97	WCM	75-01-4
Bromomethane	ND	ug/L	3	12/21/97	WCM	74 - 83 - 9
Chloroethane	ND	ug/L	5.2	12/21/97	MJW	75-00-3
Trichlorofluoromethane	ND	ug/L	5	12/21/97	WLM	75-69-4
1,1-Dichloroethene	ND	ug/L	1.3	12/21/97	WCM	75-35-4
Methylene Chloride	ND	ug/L	2.5	12/21/97	MJW	75-09-2
trans-1,2-Dichloroethene	ND	ug/L	1	12/21/97	MUM	156-60-5
1.1-Dichloroethane	ND	ug/L	0.7	12/21/97	MCM	75-34-3
Chloroform	1.4	ug/L	0.5	12/21/97	MUM	67-66-3
1.1-Trichloroethane	ND	ug/L	0.5	12/21/97	WLM	71-55-6
Carbon Tetrachloride	ND	ug/L	1.2	12/21/97	WCM	56-23-5
Benzene	ND	ug/L	2	12/21/97	MUM	71-43-2
1.2-Dichloroethane	ND	ug/L	0.5	12/21/97	MUM	107-06-2
cis-1,3-Dichloropropene	ND	ug/L	3.4	12/21/97	WCM	10061-01-5
Trichloroethene	ND	ug/L	1.2	12/21/97	MUM	79-01-6
1.2-Dichloropropane	ND	ug/L	0.5	12/21/97	MUM	78-87-5
Bromodichloromethane	ND	ug/L	1	12/21/97	MUM	75-27-4
Toluene	ND	ug/L	2	12/21/97	MUM	108-88-3
1.1.2 Trichloroethane	ND	ug/L	0.5	12/21/97	MCM	79-00-5
trans-1,3-Dichloropropene	ND	ug/L	0.6	12/21/97	WLM	10061-02-6
Tetrachloroethene	ND	ug/L	0.5	12/21/97	MUM	127-18-4
Dibromochloromethane	ND	ug/L	0.9	12/21/97	WCM	124-48-1
Chlorobenzene	ND	ug/L	0.7	12/21/97	MJW	108-90-7
Ethylbenzene	ND	ug/L	2	12/21/97	WCM	100-41-4
Bromoform	ND	ug/L	2	12/21/97	MUM	75-25-2
1,1,2,2-Tetrachloroethane	ND	ug/L	0.5	12/21/97	WCM	79-34-5
Xylene (Total)	ND	ug/L	7	12/21/97	WLM	1330-20-7
1.3-Dichlorobenzene	ND	ug/L	1	12/21/97	MJW	541 - 73 - 1
1.4-Dichlorobenzene	ND	ug/L	1	12/21/97	MUM	106-46-7
1.2-Dichlorobenzene	ND	ug/L	1	12/21/97	WCM	95-50-1
Naphthalene	ND	ug/L	5	12/21/97	MCM	91 - 20 - 3
Methyl-tert-butyl Ether	ND	ug/L	10	12/21/97	WCM	1634-04-4
Dichlorodifluoromethane	ND	ug/L	5	12/21/97	WCM	75-71-8
a.a.a-Trifluorotoluene (S)	94	*		12/21/97	WLM	2164-17-2
4-Dichlorobutane (S)	102	*		12/21/97	MJW	110-56-5

GC -- Semi-VOA

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Pace Sample No: Client Sample ID:	601638489 P7-W-1D					2/11/97		Matrix: Water
Parameters		Results	Units	PRL	Analyzed	Analys	t CAS#	Footnotes
Total Extractable		Meth	 od: 0 A 2			Prep Me	ethod: OA2	
Mineral Spirits	•	ND	mg/L	0.4	12/19/97	•		
Jet Fuel		ND	mg/L	0.4	12/19/97	EMA		
Kerosene		ND	mg/L	0.4	12/19/97	EMA		
Diesel Fuel		ND	mg/L	0.4	12/19/97	EMA	11-84-7	
Fuel Oil		ND	mg/L	0.4	12/19/97	EMA		
Motor Oil		ND	mg/L	0.4	12/19/97	EMA		
p-Terphenyl (S)		93	*		12/19/97	EMA	92 - 94 - 4	
n-Tetracosane (S	5)	87	*		12/19/97	EMA	646 - 31 - 1	
Date Extracted					12/17/97			

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Pace Project Number: 6019010 Client Project ID: Marco, KS

Pace Sample No: 601638497 Date Collected: 12/12/97 Matrix: Soil

Client Sample ID: P14-S-ID Date Received: 12/14/97

Parameters Results Units PRL Analyzed Analyst CAS# Footnotes

GC -- Volatiles

Halogen. & Aromatic Vol. Orgs.	Me	thod: EPA 802	21		Prep	Method: 5030 Med Lvl Soi
Chloromethane	420	ug/kg	20	12/24/97	MUM	74 - 87 - 3
Vinyl Chloride	ND	ug/kg	46	12/24/97	MUM	75-01-4
Bromomethane	ND	ug/kg	76	12/24/97	MJW	74 - 83 - 9
Chloroethane	ND	ug/kg	130	12/24/97	WLM	75-00-3
Trichlorofluoromethane	ND	ug/kg	130	12/24/97	WCM	75-69-4
1.1-Dichloroethene	ND	ug/kg	34	12/24/97	WCM	75-35-4
Methylene Chloride	ND	ug/kg	64	12/24/97	WCM	75-09-2
trans-1.2-Dichloroethene	ND	ug/kg	26	12/24/97	MCM	156-60-5
1.1-Dichloroethane	ND	ug/kg	18	12/24/97	MCM	75 - 34 - 3
Chloroform	ND	ug/kg	13	12/24/97	MCM	67-66-3
1.1-Trichloroethane	MD	ug/kg	13	12/24/97	MUM	71-55-6
Jarbon Tetrachloride	ND	ug/kg	30	12/24/97	MCM	56-23-5
Benzene	ND	ug/kg	50	12/24/97	MCM	71-43-2
1.2-Dichloroethane	ND	ug/kg	13	12/24/97	MJW	107-06-2
cis-1.3-Dichloropropene	ND	ug/kg	86	12/24/97	MCM	10061-01-5
Trichloroethene	ND	ug/kg	30	12/24/97	WCM	79-01-6
1.2-Dichloropropane	ND	ug/kg	13	12/24/97	MJW	78 - 87 - 5
Bromodichloromethane	ND	ug/kg	26	12/24/97	WCM	75 - 27 - 4
Toluene	ND	ug/kg	50	12/24/97	WCM	108-88-3
1.1.2-Trichloroethane	ND	ug/kg	13	12/24/97	MJW	79-00-5
trans-1,3-Dichloropropene	ND	ug/kg	15	12/24/97	WCM	10061 - 02 - 6
Tetrachloroethene	ND	ug/kg	13	12/24/97	WCM	127-18-4
Dibromochloromethane	ND	ug/kg	24	12/24/97	WCM	124-48-1
Chlorobenzene	ND	ug/kg	18	12/24/97	WCM	108-90-7
Ethylbenzene	ND	ug/kg	50	12/24/97	WCM	100-41-4
Bromoform	ND	ug/kg	50	12/24/97	MCM	75-25-2
1.1.2.2-Tetrachloroethane	ND	ug/kg	13	12/24/97	MCM	79-34-5
Xylene (Total)	ND	ug/kg	180	12/24/97	MCM	1330-20-7
1,3-Dichlorobenzene	ND	ug/kg	26	12/24/97	WCM	541-73-1
1.4-Dichlorobenzene	ND	ug/kg	26	12/24/97	MJW	106-46-7
1,2-Dichlorobenzene	ND	ug/kg	26	12/24/97	MUM	95-50-1
Naphthalene	130	ug/kg	130	12/24/97	MJW	91-20-3
Methyl-tert-butyl Ether	ND	ug/kg	260	12/24/97	WCM	1634 - 04 - 4
Dichlorodifluoromethane	ND	ug/kg	70	12/24/97	MUW	75-71-8
a.a.a-Trifluorotoluene (S)	86	*		12/24/97	MUM	2164 - 17 - 2
4-Dichlorobutane (S)	97	*		12/24/97	MJW	110-56-5

GC -- Semi-VOA

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Pace Project Number: 6019010

Client Project ID: Marco, KS

601638497 Date Collected: 12/12/97 Matrix: Soil

Pace Sample No:	601638497			Date Collec	-	2/12/97		Matrix: Soil
Client Sample ID:	P14-S-1D			Date Recei	ived: 12	2/14/97		
Parameters		Results	Units	PRL	Analyzed	Analyst	CAS#	Footnotes
Total Extractable	Hydrocarbons	Metho	d: 0A2			Prep Me	 thod: 0A2	• •••••
Mineral Spirits		ND	mg/kg	8.5	12/20/97	EMA.		
Jet Fuel		ND	mg/kg	8.5	12/20/97	EMA		
Kerosene		ND	mg/kg	8.5	12/20/97	EMA		
Diesel Fuel		ND	mg/kg	8.5	12/20/97	EMA	11-84-7	
Fuel Oil		ND	mg/kg	8.5	12/20/97	EMA		
Motor Oil		ND	mg/kg	8.5	12/20/97	EMA		
n-Tetracosane (S	5)	94	*		12/20/97	EMA (646-31-1	
p-Terphenyl (S)		98	*		12/20/97	EMA ·	92 - 94 - 4	
Date Extracted					12/19/97			

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DATE: 12/29/97

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Pace Project Number: 6019010 Client Project ID: Marco, KS

Date Collected: 12/12/97 Pace Sample No: 601638505 Matrix: Water

Client Sample ID: P14-W-1D Date Received: 12/14/97

Results Units PRL Analyzed Analyst CAS# Footnotes Parameters

GC Volatiles

alogen. & Aromatic Vol. Orgs.	Me	thod: EPA 80	21		Prep	Method: EPA 8021
Chloromethane	ND	ug/L	8.0	12/21/97	MUM	74 - 87 - 3
Vinyl Chloride	ND	ug/L	1.8	12/21/97	MUM	75-01-4
Bromomethane	ND	ug/L	3	12/21/97	MCM	74 - 83 - 9
Chloroethane	ND	ug/L	5.2	12/21/97	WCM	75-00-3
Trichlorofluoromethane	ND	ug/L	5	12/21/97	MUM	75-69-4
1.1-Dichloroethene	ND	ug/L	1.3	12/21/97	MUM	75-35-4
Methylene Chloride	ND	ug/L	2.5	12/21/97	MUM	75-09-2
trans-1.2-Dichloroethene	ND	ug/L	1	12/21/97	MCM	156-60-5
1.1-Dichloroethane	ND	ug/L	0.7	12/21/97	WCM	75 - 34 - 3
Shloroform	ND	ug/L	0.5	12/21/97	WCM	67 - 66 - 3
1.1-Trichloroethane	ND	ug/L	0.5	12/21/97	MUM	71 - 55 - 6
Larbon Tetrachloride	ND	ug/L	1.2	12/21/97	MUM	56-23-5
Benzene	ND	ug/L	2	12/21/97	MJW	71-43-2
1.2-Dichloroethane	ND	ug/L	0.5	12/21/97	MJW	107-06-2
cis-1,3-Dichloropropene	ND	ug/L	3.4	12/21/97	WCM	10061-01-5
Trichloroethene	ND	ug/L	1.2	12/21/97	WCM	79-01-6
1.2-Dichloropropane	ND	ug/L	0.5	12/21/97	WCM	78-87-5
Bromodichloromethane	ND	ug/L	1	12/21/97	WCM	75-27-4
Toluene	ND	ug/L	2	12/21/97	WLM	108-88-3
1.1.2-Trichloroethane	ND	ug/L	0.5	12/21/97	MUM	79-00-5
trans-1.3-Dichloropropene	ND	ug/L	0.6	12/21/97	MUM	10061-02-6
Tetrachloroethene	ND	ug/L	0.5	12/21/97	WCM	127-18-4
Dibromochloromethane	ND	ug/L	0.9	12/21/97	MJW	124-48-1
Chlorobenzene	ND	ug/L	0.7	12/21/97	MJW	108-90-7
Ethylbenzene	ND	ug/L	2	12/21/97	MJW	100-41-4
Bromoform	ND	ug/L	2	12/21/97	MCM	75-25-2
1.1.2.2-Tetrachloroethane	ND	ug/L	0.5	12/21/97	MJW	79-34-5
Xylene (Total)	ND	ug/L	7	12/21/97	MJW	1330-20-7
1,3-Dichlorobenzene	ND	ug/L	1	12/21/97	MUM	541 - 73 - 1
1,4-Dichlorobenzene	ND	ug/L	1	12/21/97	MJW	106-46-7
1.2-Dichlorobenzene	ND	ug/L	1	12/21/97	MUM	95-50-1
Naphthalene	ND	ug/L	5	12/21/97	MCM	91-20-3
Methyl-tert-butyl Ether	ND	ug/L	10	12/21/97	MUM	1634 - 04 - 4
Dichlorodifluoromethane	ND	ug/L	5	12/21/97	MJW	75 - 71 - 8
a.a.a-Trifluorotoluene (S)	93	*		12/21/97	WLM	2164 - 17 - 2
4-Dichlorobutane (S)	103	*		12/21/97	MJW	110-56-5

GC -- Semi-VOA

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Pace Project Number: 6019010 Client Project ID: Marco, KS

Pace Sample No:

601638505

Date Collected:

12/12/97

Matrix: Water

12/14/97 Date Received:

Client Sample ID: P14-W-1D	Date Received: 12/14/97					
Parameters	Results	Units	PRL	Analyzed	Analyst CAS# Footnotes	
Total Extractable Hydrocarbons	Metho	od: 0A2		• • • • • • • • • • • • • • • • • • • •	Prep Method: OA2	
Mineral Spirits	ND	mg/L	0.4	12/19/97	EMA	
Jet Fuel	ND	mg/L	0.4	12/19/97	EMA	
Kerosene	ND	mg/L	0.4	12/19/97	EMA	
Diesel Fuel	ND	mg/L	0.4	12/19/97	EMA 11-84-7	
Fuel Oil	ND	mg/L	0.4	12/19/97	EMA	
Motor 0il	ND	mg/L	0.4	12/19/97	EMA	
p-Terphenyl (S)	96	*		12/19/97	EMA 92-94-4	
n-Tetracosane (S)	83	*		12/19/97	EMA 646-31-1	
Date Extracted				12/17/97		

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Pace Project Number: 6019010 Client Project ID: Marco, KS

Date Collected: 601638513 12/12/97 Matrix: Water Pace Sample No:

Client Sample ID: P2-W-1D Date Received: 12/14/97

Results Units PRL Analyzed Analyst CAS# Footnotes Parameters

GC

Halogen. & Aromatic Vol. Orgs.	Me	thod: EPA 80.	21		Prep	Method: EPA 8023
Chloromethane	ND	ug/L	0.8	12/21/97	MJW	74 - 87 - 3
Vinyl Chloride	ND	ug/L	1.8	12/21/97	WCM	75-01-4
Bromomethane	ND	ug/L	3	12/21/97	WCM	74-83-9
Chloroethane	ND	ug/L	5.2	12/21/97	MCM	75 - 00 - 3
Trichlorofluoromethane	ND	ug/L	5	12/21/97	MJW	75-69-4
1.1-Dichloroethene	ND	ug/L	1.3	12/21/97	MJW	75-35-4
Methylene Chloride	ND	ug/L	2.5	12/21/97	MUM	75-09-2
trans-1,2-Dichloroethene	ND	ug/L	1	12/21/97	MJW	156-60-5
1,1-Dichloroethane	ND	ug/L	0.7	12/21/97	MJW	75 - 34 - 3
Chloroform	ND	ug/L	0.5	12/21/97	MUM	67-66-3
1.1-Trichloroethane	ND	ug/L	0.5	12/21/97	MJW	71-55-6
_arbon Tetrachloride	CM	ug/L	1.2	12/21/97	MJW	56-23-5
Benzene	12	ug/L	2	12/21/97	MJW	71-43-2
1.2-Dichloroethane	4.8	ug/L	0.5	12/21/97	MUM	107-06-2
cis-1.3-Dichloropropene	ND	ug/L	3.4	12/21/97	WCM	10061-01-5
Trichloroethene	ND	ug/L	1.2	12/21/97	WCM	79-01-6
1.2-Dichloropropane	ND	ug/L	0.5	12/21/97	MJW	78-87-5
Bromodichloromethane	ND	ug/L	1	12/21/97	MJW	75-27-4
Toluene	2.9	ug/L	2	12/21/97	WCM	108-88-3
1.1.2-Trichloroethane	ND	ug/L	0.5	12/21/97	MJW	79-00-5
trans-1,3-Dichloropropene	ND	ug/L	0.6	12/21/97	MJW	10061-02-6
Tetrachloroethene	ND	ug/L	0.5	12/21/97	WCM	127 - 18 - 4
Dibromochloromethane	ND	ug/L	0.9	12/21/97	WCM	124 - 48 - 1
Chlorobenzene	2.5	ug/L	0.7	12/21/97	WLM	108-90-7
Ethylbenzene	ND	ug/L	2	12/21/97	MJW	100-41-4
Bromoform	DM	ug/L	2	12/21/97	MUM	75-25-2
1.1.2.2-Tetrachloroethane	ND	ug/L	0.5	12/21/97	MJW	79 - 34 - 5
Xylene (Total)	7.5	ug/L	7	12/21/97	MJW	1330 - 20 - 7
1.3-Dichlorobenzene	ND	ug/L	1	12/21/97	MJW	541 - 73 - 1
1.4-Dichlorobenzene	ND	ug/L	1	12/21/97	MUM	106-46-7
1.2 Dichlorobenzene	2.6	ug/L	1	12/21/97	WCM	95-50-1
Naphthalene	ND	ug/L	5	12/21/97	MJW	91 - 20 - 3
Methyl-tert-butyl Ether	ND	ug/L	10	12/21/97	WCM	1634 - 04 - 4
Dichlorodifluoromethane	ND	ug/L	5	12/21/97	WCM	75-71-8
a.a.a-Trifluorotoluene (S)	192	*		12/21/97	WCM	2164 - 17 - 2
* 4-Dichlorobutane (S)	100	1		12/21/97	MUM	110-56-5

GC -- Semi-VOA

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Pace Project Number: 6019010 Client Project ID: Marco, KS

Pace Sample No: Client Sample ID:	601638513 P2-W-1D					2/12/97 2/14/97		Matrix: Water
Parameters		Results	Units	PRL	Analyzed	Analys	t CAS#	Footnotes
Total Extractable H	ydrocarbons	Meth	od: 0A2			Prep M	ethod: 0A2	
Mineral Spirits		ND	mg/L	0.4	12/19/97	EMA		
Jet Fuel		ND	mg/L	0.4	12/19/97	EMA		
Kerosene		ND	mg/L	0.4	12/19/97	EMA		
Diesel Fuel		ND	mg/L	0.4	12/19/97	EMA	11-84-7	
Fuel Oil		ND	mg/L	0.4	12/19/97	EMA		
Motor Oil		ND	mg/L	0.4	12/19/97	EMA		
p-Terphenyl (S)		84	*		12/19/97	EMA	92 - 94 - 4	
n-Tetracosane (S)		76	*		12/19/97	EMA	646-31-1	
Date Extracted					12/17/97			

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Pace Project Number: 6019010 Client Project ID: Marco, KS

12/13/97 Pace Sample No: 601638521 Date Collected: Matrix: Water P3-W-1D Date Received: 12/14/97 Client Sample ID: Results Units PRL Analyzed Analyst CAS# **Parameters** Footnotes . GC · Volatiles Method: EPA 8021 Halogen. & Aromatic Vol. Orgs. Prep Method: EPA 8021 12/21/97 MJW 74-87-3 Chloromethane ND ug/L 0.8 Vinyl Chloride ND ug/L 1.8 12/21/97 MJW 75-01-4 Bromomethane ND ug/L 3 12/21/97 MUM 74-83-9 ND 12/21/97 MUM 75-00-3 Chloroethane ug/L 5.2 Trichlorofluoromethane ND ug/L 12/21/97 MJW 75-69-4 1.1-Dichloroethene ND ug/L 12/21/97 MUM 75-35-4 1.3 Methylene Chloride ND ug/L 2.5 12/21/97 MJW 75-09-2 trans-1,2-Dichloroethene ND 156-60-5 ug/L 12/21/97 MUM 1 75 - 34 - 3 1.1-Dichloroethane ND ug/L 0.7 12/21/97 MJW. ND 12/21/97 MJW 67-66-3 Chloroform ug/L 0.5 1.1.Trichloroethane ND ug/L 0.5 12/21/97 M.1V 71-55-6 arbon Tetrachloride ND ug/L 1.2 12/21/97 MJW 56-23-5 ND ug/L 12/21/97 MIN 71-43-2 Benzene 2 107-06-2 ND ug/L 0.5 12/21/97 MJW 1.2.Dichloroethane cis-1,3-Dichloropropene ND ug/L 3.4 12/21/97 MUM 10061-01-5 ND ug/L 1.2 12/21/97 79.01.6 Trichloroethene MUM 1.2 Dichloropropane ND ug/L 0.5 12/21/97 MJW 78-87-5 Bromodichloromethane ND ug/L 1 12/21/97 MJW 75-27-4 12/21/97 MJW ND ug/L 2 108-88-3 Toluene 1.1.2-Trichloroethane ND ug/L 0.5 12/21/97 MUW 79-00-5 ND M. IN 10061-02-6 trans-1,3-Dichloropropene uq/L 0.6 12/21/97 Tetrachloroethene ND ug/L 0.5 12/21/97 M. IV 127-18-4 Dibromochloromethane ND ug/L 0.9 12/21/97 MJW 124-48-1 108-90-7 Chlorobenzene ND ug/L 0.7 12/21/97 M.IW ND 12/21/97 100-41-4 Ethylbenzene ug/L 2 M.JW Bromoform ND ug/L 2 12/21/97 MJW. 75 - 25 - 2 1,1,2,2-Tetrachloroethane ND ug/L 0.5 12/21/97 MJW 79-34-5 Xylene (Total) ND ug/L 7 12/21/97 MJW 1330-20-7 1.3 Dichlorobenzene ND ug/L 1 12/21/97 MJW 541 - 73 - 1 1.4 Dichlorobenzene ND ug/L 106-46-7 1 12/21/97 MJW 1.2-Dichlorobenzene ND ug/L 1 12/21/97 MJW 95-50-1 ND ug/L 5 91 - 20 - 3 Naphthalene 12/21/97 MJW Methyl-tert-butyl Ether ND ug/L 10 12/21/97 MUW 1634 - 04 - 4 ND ug/L 5 12/21/97 75-71-8 Dichlorodifluoromethane M.11

GC -- Semi-VOA

a.a.a.Trifluorotoluene (S)

4-Dichlorobutane (S)

93

104

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12/21/97

12/21/97 MJW

MJW

2164 - 17 - 2

110-56-5

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Matrix: Water

Pace Project Number: 6019010 Client Project ID: Marco, KS

Pace Sample No: 601638521 Date Collected: 12/13/97

Client Sample ID: P3-W-1D			Date Rece	ived: 12	2/14/97	
Parameters	Results	Units	PRL	Analyzed	Analyst CAS#	Footnotes
Total Extractable Hydrocarbons	Metho	od: 0A2		•••••	Prep Method: 0A2	
Mineral Spirits	ND	mg/L	0.4	12/19/97	EMA	
Jet Fuel	ND	mg/L	0.4	12/19/97	EMA	
Kerosene	ND	mg/L	0.4	12/19/97	EMA	
Diesel Fuel	ND	mg/L	0.4	12/19/97	EMA 11-84-7	
Fuel Oil	ND	mg/L	0.4	12/19/97	EMA	
Motor Oil	ND	mg/L	0.4	12/19/97	EMA	
p-Terphenyl (S)	103	*		12/19/97	EMA 92 - 94 - 4	
n-Tetracosane (S)	94	*		12/19/97	EMA 646-31-1	
Date Extracted				12/17/97		

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Pace Project Number: 6019010 Client Project ID: Marco, KS

Pace Sample No:

601638547

Date Collected:

12/13/97

Matrix: Water

Client Sample ID:

P15-W-1D

Date Received:

12/14/97

Parameters	Results	Units	PRL	Analyzed	Analyst	: CAS#	Footnotes

GC

ologen. & Aromatic Vol. Orgs.		Method: EPA 802	21		Prep	Method: EPA 8021
Chloromethane	ND	ug/L	0.8	12/21/97	MUM	74-87-3
Vinyl Chloride	ND	ug/L	1.8	12/21/97	WCM	75-01-4
Bromomethane	ND	ug/L	3	12/21/97	MJW	74 - 83 - 9
Chloroethane	ND	ug/L	5.2	12/21/97	MUM	75-00-3
Trichlorofluoromethane	ND	ug/L	5	12/21/97	WCM	75-69-4
1.1-Dichloroethene	ND	ug/L	1.3	12/21/97	WCM	75-35-4
Methylene Chloride	ND	ug/L	2.5	12/21/97	WCM	75-09-2
trans-1.2-Dichloroethene	ND	ug/L	1	12/21/97	WCM	156-60-5
1.1-Dichloroethane	ND	ug/L	0.7	12/21/97	MJW	75-34-3
Chloroform	ND	ug/L	0.5	12/21/97	MJW	67-66-3
1.1-Trichloroethane	ND	ug/L	0.5	12/21/97	MJW	71-55-6
Jarbon Tetrachloride	ND	ug/L	1.2	12/21/97	WLM	56-23-5
Benzene	ND	ug/L	2	12/21/97	WLM	71-43-2
1.2-Dichloroethane	ND	ug/L	0.5	12/21/97	WLM	107-06-2
cis-1,3-Dichloropropene	ND	ug/L	3.4	12/21/97	MUM	10061-01-5
Trichloroethene	ND	ug/L	1.2	12/21/97	WLM	79-01-6
1.2-Dichloropropane	ND	ug/L	0.5	12/21/97	WCM	78 - 87 - 5
Bromodichloromethane	ND	ug/L	1	12/21/97	MJW	75 - 27 - 4
Toluene	ND	ug/L	2	12/21/97	MUM	108-88-3
1.1.2-Trichloroethane	ND	ug/L	0.5	12/21/97	MJW	79-00-5
trans-1,3-Dichloropropene	ND	ug/L	0.6	12/21/97	WCM	10061-02-6
Tetrachloroethene	ND	ug/L	0.5	12/21/97	WCM	127-18-4
Dibromochloromethane	ND	ug/L	0.9	12/21/97	MJW	124 - 48 - 1
Chlorobenzene	ND	ug/L	0.7	12/21/97	MJW	108-90-7
Ethylbenzene	ND	ug/L	2	12/21/97	WCM	100-41-4
Bromoform	ND	ug/L	2	12/21/97	WCM	75-25-2
1.1.2.2-Tetrachloroethane	ND	ug/L	0.5	12/21/97	MJW	79-34-5
Xylene (Total)	ND	ug/L	7	12/21/97	WCM	1330-20-7
1,3-Dichlorobenzene	ND	ug/L	1	12/21/97	WLM	541-73-1
1.4-Dichlorobenzene	ND	ug/L	1	12/21/97	WCM	106-46-7
1.2-Dichlorobenzene	ND	ug/L	1	12/21/97	WCM	95-50-1
Naphthalene	ND	ug/L	5	12/21/97	MJW	91 - 20 - 3
Methyl·tert-butyl Ether	ND	ug/L	10	12/21/97	MCM	1634 - 04 - 4
Dichlorodifluoromethane	ND	ug/L	5	12/21/97	MCM	75-71-8
a.a.a-Trifluorotoluene (S)	97	*		12/21/97	WCM	2164-17-2
4-Dichlorobutane (S)	82	*		12/21/97	MJW	110-56-5

REPORT OF LABORATORY ANALYSIS

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Tel 913-599-5665 Fax 913-599-1759

DATE: 12/29/97 PAGE: 19

Pace Project Number: 6019010 Client Project ID: Marco, KS

Pace Sample No:

601638554

Date Collected:

12/13/97

Matrix: Water

Client Sample ID:

P20-W-1D

Date Received:

12/14/97

x: water

Parameters

D--

Results Units PRL

Analyzed Analyst CAS#

Footnotes

GC -- Volatiles

Halogen. & Aromatic Vol. Orgs.	Me	thod: EPA 80	21		Prep	Method: EPA 802
Chloromethane	ND	ug/L	8.0	12/21/97	MCM	74 - 87 - 3
Vinyl Chloride	ND	ug/L	1.8	12/21/97	WCM	75-01-4
Bromomethane	ND	ug/L	3	12/21/97	MJW	74 - 83 - 9
Chloroethane	ND	ug/L	5.2	12/21/97	MJW	75-00-3
Trichlorofluoromethane	ND	ug/L	5	12/21/97	WLM	75-69-4
1.1-Dichloroethene	ND	ug/L	1.3	12/21/97	MJW	75-35-4
Methylene Chloride	ND	ug/L	2.5	12/21/97	MJW	75-09-2
trans-1,2-Dichloroethene	ND	ug/L	1	12/21/97	MJW	156-60-5
1.1-Dichloroethane	ND	ug/L	0.7	12/21/97	MJW	75-34-3
Chloroform	ND	ug/L	0.5	12/21/97	MJW	67 - 66 - 3
.1,1-Trichloroethane	ND	ug/L	0.5	12/21/97	MJW	71-55-6
Jarbon Tetrachloride	ND	ug/L	1.2	12/21/97	WCM	56-23-5
Benzene	ND	ug/L	2	12/21/97	MJW	71 - 43 - 2
1,2-Dichloroethane	ND	ug/L	0.5	12/21/97	WCM	107-06-2
cis-1,3-Dichloropropene	ND	ug/L	3.4	12/21/97	WCM	10061-01-5
Trichloroethene	ND	ug/L	1.2	12/21/97	WCM	79-01-6
1.2-Dichloropropane	ND	ug/L	0.5	12/21/97	WCM	78-87-5
Bromodichloromethane	ND	ug/L	1	12/21/97	WCM	75-27-4
Toluene	ND	ug/L	2	12/21/97	WCM	108-88-3
1.1.2-Trichloroethane	ND	ug/L	0.5	12/21/97	MUM	79-00-5
trans-1,3-Dichloropropene	ND	ug/L	0.6	12/21/97	WCM	10061-02-6
Tetrachloroethene	ND	ug/L	0.5	12/21/97	WCM	127-18-4
Dibromochloromethane	ND	ug/L	0.9	12/21/97	WLM	124 - 48 - 1
Chlorobenzene	0.71	ug/L	0.7	12/21/97	WCM	108-90-7
Ethylbenzene	ND	ug/L	2	12/21/97	WLM	100-41-4
Bromoform	ND	ug/L	2	12/21/97	WCM	75-25-2
1.1.2.2-Tetrachloroethane	ND	ug/L	0.5	12/21/97	WCM	79-34-5
Xylene (Total)	ND	ug/L	7	12/21/97	MJ₩	1330-20-7
1.3-Dichlorobenzene	ND	ug/L	1	12/21/97	MJW	541-73-1
1.4-Dichlorobenzene	1.1	ug/L	1	12/21/97	WLM	106-46-7
1.2-Dichlorobenzene	2.2	ug/L	1	12/21/97	MUM	95-50-1
Naphthalene	ND	ug/L	5	12/21/97	MJW	91 - 20 - 3
Methyl-tert-butyl Ether	ND	ug/L	10	12/21/97	MJW	1634 - 04 - 4
Dichlorodifluoromethane	ND	ug/L	5	12/21/97	MJW	75 - 71 - 8
a,a,a-Trifluorotoluene (S)	115	*		12/21/97	MUM	2164 - 17 - 2
4-Dichlorobutane (S)	103	*		12/21/97	MUM	110-56-5

REPORT OF LABORATORY ANALYSIS

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> Tel 913-599-5665 Fax 913-599-1759

DATE: 12/29/97 PAGE: 20

Pace Project Number: 6019010 Client Project ID: Marco, KS

PARAMETER FOOTNOTES

ND Not Detected
NC Not Calculable
PRL Pace Reporting Limit

(S) Surrogate

[1] Analyte is found in the associated blank as well as in the sample (CLP B-Flag).

[2] Matrix interference of a.a.a-trifluorotoluene is indicated by the 145% recovery of the secondary surrogate

bromochlorobenzene.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

DATE: 12/29/97

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GOLDER ASSOCIATES INC 200 UNION BOULEVARD

SUITE 500

LAKEWOOD, CO 80228

Pace Project Number: 6019010 Client Project ID: Marco, KS

Attn: Mr. RANDY MARCH Phone: (303)980-0540

QC Batch ID: 39877

Analysis Method: 0A2 Associated Pace Samples:

QC Batch Method: OA2

Analysis Description: Total Extractable Hydrocarbons 601638505 601638513 601638521

601638455 601638489

METHOD BLANK: 601638562

Associated Pace Samples:

	601638455	601638489 Method	601638505	601638513	601638521
		Blank			
Parameter	Units	Result	PRL	Footnotes	
M al Spirits	mg/L	ND ND	0.4		
Jet Fuel	mg/L	ND	0.4		
Kerosene	mg/L	ND	0.4		
Diesel Fuel	mg/L	ND	0.4		
Fuel 011	mg/L	ND	0.4		
Motor 0:1	mg/L	ND	0.4		
p-Terphenyl (S)	*	95			
n-Tetracosane (S)	*	88			

MATRIX SPIKE & MATRIX SPIKE DUF	PLICATE: 60163	88570 60163	8588	Matrix		Matrix	Spike		
			Spike	Spike	Spike	Sp. Dup.	Dup		
Parameter	Units	601638455	Conc.	Result	‡ Rec	Result	1 Rec	RPD	Footnotes
		· · · · · · · · · · · ·	• • • • • • •	• • • • • • • • • •					
Diesel Fuel	mg/L	0	12.5	11.19	89.5	12.62	101	12	
p-Terphenyl (S)					96		92		
n-Tetracosane (S)					90		89		

LABORATORY CONTROL SAMPLE: 601638596

		Spike	_	Spike	.
Parameter	Units	Conc.	Result	≭ Rec	Footnotes
• • • • • • • • • • • • • • • • • • • •			• • • • • • • • • • • • • • • • • • • •	• • • • •	• • • • • • • • • •
Diesel Fuel	mg/L	12.5	11.58	92.7	
p· ~henyl (S)				101	

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QUALITY CONTROL DATA

DATE: 12/29/97

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Pace Project Number: 6019010 Client Project ID: Marco, KS

LABORATORY CONTROL SAMPLE: 601638596

Spike LCS

Spike

Units Parameter

Conc. Result

∦ Rec Footnotes

n-Tetracosane (S)

95

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QUALITY CONTROL DATA

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GOLDER ASSOCIATES INC 200 UNION BOULEVARD

SUITE 500

LAKEWOOD. CO 80228

Pace Project Number: 6019010 Client Project ID: Marco, KS

Attn: Mr. RANDY MARCH Phone: (303)980-0540

QC Batch ID: 39930

QC Batch Method: OA2

Analysis Method: 0A2

Analysis Description: Total Extractable Hydrocarbons

Associated Pace Samples:

601638414

METHOD BLANK: 601641798 Associated Pace Samples:

601638414

Parameter	Units	Result	PRL	Footnotes
M al Spirits	mg/kg	ND	10	
Jet Fuel	mg/kg	ND	10	
Kerosene	mg/kg	ND	10	
Diesel Fuel	mg/kg	ND	10	
Fuel Oil	mg/kg	ND	10	
Motor Oil	mg/kg	ND	10	
n-Tetracosane (S)	*	83		
p-Terphenyl (S)	*	82		

MATRIX SPIKE & MATRIX SPIKE DU	PLICATE: 60164	1806 60164	1814	Matrix		Matrix	Spike		
			Spike	Spike	Spike	Sp. Dup.	Dup		
Parameter	Units	601620024	Conc.	Result	≵ Rec	Result	# Rec	RPD	Footnotes
Diesel Fuel	mg/kg	0	495	400.9	81.0	472.1	95.0	16	• • • • • • • • • • • • • • • • • • • •
n-Tetracosane (S)					76		79		
p-Terphenyl (S)					82		84		

LABORATORY CONTROL SAMPLE: 601641822

		Spike	LCS	Spike	
Parameter	Units	Conc.	Result	≵ Rec	Footnotes
		· · · · · ·			
Diesel Fuel	mg/kg	500	451.6	90.3	
n racosane (S)				77	

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Pace Project Number: 6019010 Client Project ID: Marco, KS

LABORATORY CONTROL SAMPLE: 601641822

Spike LCS Conc. Result Spike

Parameter Units

♣ Rec Footnotes

p-Terphenyl (S)

82

		-

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QUALITY CONTROL DATA

DATE: 12/29/97 PAGE: 25

GOLDER ASSOCIATES INC 200 UNION BOULEVARD

SUITE 500

LAKEWOOD, CO 80228

Pace Project Number: 6019010 Client Project ID: Marco, KS

Attn: Mr. RANDY MARCH Phone: (303)980-0540

QC Batch ID: 40030

Analysis Method: 0A2

601638471

QC Batch Method: OA2

Analysis Description: Total Extractable Hydrocarbons

601638497 601638471 Associated Pace Samples:

METHOD BLANK: 601645930

Associated Pace Samples:

		Method			
Parameter	Units	Result	PRL	Footnotes	
			• • • • • • • • • • • • • • • • • • • •		
M al Spirits	mg/kg	ПD	10		
Jet Fuel	mg/kg	ND	10		
Kerosene	mg/kg	ND	10		
Diesel Fuel	mg/kg	ND	10		
Fuel Oil	mg∕kg	ND	10		
Motor 0:1	mg/kg	ND	10		
n-Tetracosane (S)	*	99			
p·Terphenyl (S)	*	104			

601638497

MATRIX SPIKE & MATRIX SPIKE D	UPLICATE: 6016	45948 60164	5955	Matrix		Matrix	Spike		
			Spike	Spike	Spike	Sp. Dup.	Dup		
Parameter	Units	601633266	Conc.	Result	∤ Rec	Result	1 Rec	RPD	Footnotes
• • • • • • • • • • • • • • • • • • • •					• • • • •	• • • • • • • • • • •			
Diesel Fuel	mg/kg	0	489.2	448.7	91.7	475.8	98.8	7	
n-Tetracosane (S)					98		100		
p-Terphenyl (S)					103		106		

LABORATORY CONTROL SAMPLE: 601645963

		Spike	LCS	Spike	
Parameter	Units	Conc.	Result	≵ Rec	Footnotes
•••••					
Diesel Fuel	mg/kg	500	468.3	93.7	
n. Tracosane (S)				98	

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QUALITY CONTROL DATA

DATE: 12/29/97

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Pace Project Number: 6019010 Client Project ID: Marco, KS

LABORATORY CONTROL SAMPLE: 601645963

Spike LCS

Spike

Units Parameter

Conc. Result # Rec Footnotes

p-Terphenyl (S)

104

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GOLDER ASSOCIATES INC 200 UNION BOULEVARD

SUITE 500

LAKEWOOD, CO 80228

Pace Project Number: 6019010 Client Project ID: Marco, KS

Attn: Mr. RANDY MARCH Phone: (303)980-0540

QC Batch ID: 40046

QC Batch Method: EPA 8021

Analysis Method: EPA 8021

Analysis Description: Halogen. & Aromatic Vol. Orgs.

Associated Pace Samples:

601638455 601638463

601638489 601638505

601638513

601638521 601638547 601638554

METHOD BLANK: 601648074

Associated Pace Samples:

obenzene

ug/L

ND

·	601638455	601638463 Method	601638489	601638505	601638513	601638521
		Blank				
eter	Units	Result	PRL	Footnotes		
Chloromethane	ug/L	ND	0.8			
Vinyl Chloride	ug/L	ND	1.8			
Bromomethane	ug/L	ND	3			
Chloroethane	ug/L	ND	5.2			
Trichlorofluoromethane	ug/L	ND	5			
1.1-Dichloroethene	ug/L	ND	1.3			
Methylene Chloride	ug/L	ND	2.5			
trans-1,2-Dichloroethene	ug/L	ND	1			
1.1-Dichloroethane	ug/L	ND	0.7			
Chloroform	ug/L	ND	0.5			
1.1.1-Trichloroethane	ug/L	ND	0.5			
Carbon Tetrachloride	ug/L	ND	1.2			
Benzene	ug/L	ND	2			
1.2-Dichloroethane	ug/L	ND	0.5			
cis-1.3-Dichloropropene	ug/L	ND	3.4			
Trichloroethene	ug/L	ND	1.2			
1.2-Dichloropropane	ug/L	ND	0.5			
Bromodichloromethane	ug/L	ND	1			
Toluene	ug/L	ND	2			
1.1.2-Trichloroethane	ug/L	ND	0.5			
trans-1,3-Dichloropropene	ug/L	ND	0.6			
Tetrachloroethene	ug/L	ND	0.5			
Dibromochloromethane	ug/L	ND	0.9			

REPORT OF LABORATORY ANALYSIS

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DATE: 12/29/97 PAGE: 28

Pace Project Number: 6019010 Client Project ID: Marco, KS

METHOD BLANK: 601648074

Associated Pace Samples:

Associated Pace Samples:	(01/30455	(01/204/2	601630400	(01(30505	601620512	(01(30531
	601638455	601638463 Method Blank	601638489	601638505	601638513	601638521
Parameter	Units	Result	PRL	Footnotes		
Ethy1benzene	ug/L	ND	2			
Bromoform	ug/L	ND	2			
1.1.2.2 · Tetrachloroethane	ug/L	ND	0.5			
Xylene (Total)	ug/L	ND	7			
1.3-Dichlorobenzene	ug/L	ND	1			
1.4 Dichlorobenzene	ug/L	ND	1			
1.2-Dichlorobenzene	ug/L	ND	1			
Naphthalene	ug/L	ND	5			
Methyl·tert·butyl Ether	ug/L	ND	10			
Dichlorodifluoromethane	ug/L	ND	5			
a,a,a-Trifluorotoluene (S)	*	94				
1,4-Dichlorobutane (S)	*	103				

METHOD BLANK: 601650526

Associated Pace Samples:

,	601638547	601638554 Method Blank		
Parameter	Units	Result	PRL	Footnotes
Chloromethane	ug/L	ND	0.8	
Vinyl Chloride	ug/L	ND	1.8	
Bromomethane	ug/L	ND	3	
Chloroethane	ug/L	ND	5.2	
Trichlorofluoromethane	ug/L	ND	5	
1.1-Dichloroethene	ug/L	ND	1.3	
Methylene Chloride	ug/L	ND	2.5	
trans-1,2-Dichloroethene	ug/L	ND	1	
1.1-Dichloroethane	ug/L	ND	0.7	
Chloroform	ug/L	ND	0.5	
1.1.1-Trichloroethane	ug/L	ND	0.5	
Carbon Tetrachloride	ug/L	ND	1.2	
Benzene	ug/L	ND	2	
1.2-Dichloroethane	ug/L	ND	0.5	
cis-1,3-Dichloropropene	ug/L	ND	3.4	
Trichloroethene	ug/L	ND	1.2	
1 ^ ~ chloropropane	ug/L	ND	0.5	

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QUALITY CONTROL DATA

DATE: 12/29/97

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Pace Project Number: 6019010 Client Project ID: Marco, KS

METHOD BLANK: 601650526

Associated Pace Samples:

, i	601638547	601638554 Method Blank		
Parameter	Units	Result	PRL	Footnotes
Bromodichloromethane	ug/L	ND	1	
Toluene	ug/L	ND	2	
1.1.2-Trichloroethane	ug/L	ND	0.5	
trans-1,3-Dichloropropene	ug/L	ND	0.6	
Tetrachloroethene	ug/L	ND	0.5	
Dibromochloromethane	ug/L	ND	0.9	
Chlorobenzene	ug/L	ND	0.7	
Ethylbenzene	ug/L	ND	2	
Bromoform	ug/L	ND	2	
1.1.2.2-Tetrachloroethane	ug/L	ND	0.5	
Xylene (Total)	ug/L	ND	7	
1.3 Dichlorobenzene	ug/L	ND	1	
chlorobenzene	ug/L	ND	1	
1.2 Jichlorobenzene	ug/L	ND	1	
Naphthalene	ug/L	ND	5	
Methyl-tert-butyl Ether	ug/L	ND	10	
Dichlorodifluoromethane	ug/L	ND	5	
a.a.a-Trifluorotoluene (S)	*	93		
1,4-Dichlorobutane (S)	*	92		

MATRIX SPIKE & MATRIX SPIKE	DUPLICATE: 60	1648082 60164	8090	Matrix		Matrix	Spike		
			Spike	Spike	Spike	Sp. Dup.	Dup		
Parameter	Units	601634819	Conc.	Result	‡ Rec	Result	‡ Rec	RPD	Footnotes
Chloromethane	ug/L	0	20	12.90	64.5	18.61	93.0	36	1
Vinyl Chloride	ug/L	0.06202	20	18.51	92.3	19.97	99.5	8	
Bromomethane	ug/L	0	20	19.58	97.9	22.91	115	16	
Chloroethane	ug/L	0	20	18.58	92.9	26.19	131	34	2
Trichlorofluoromethane	ug/L	0.1339	20	19.91	98.9	20.92	104	5	
1.1-Dichloroethene	ug/L	0.1163	20	21.49	107	21.35	106	1	
Methylene Chloride	ug/L	0.4555	20	23.73	116	23.58	116	1	
trans-1,2-Dichloroethene	ug/L	0.1238	20	21.89	109	22.30	111	2	
1.1-Dichloroethane	ug/L	0	20	21.95	110	22.43	112	2	
Chloroform	ug/L	3 . 624	20	25.02	107	25.59	110	3	
1.1.1-Trichloroethane	ug/L	0	20	21.81	109	23.36	117	7	
Carbon Tetrachloride	ug/L	0.1766	20	22.08	110	22.14	110	0	
B′ ne	ug/L	0	20	20.62	103	20.39	102	1	

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QUALITY CONTROL DATA

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Pace Project Number: 6019010 Client Project ID: Marco, KS

MATRIX SPIKE & MATRIX SPIKE I	DUPLICATE: 60	1648082 60164	18090 Matrix			Matrix	Spike		
			Spike	Spike	Spike	Sp. Dup.	Dup		
Parameter	Units	601634819	Conc.	Result	∦ Rec	Result	∦ Rec	RPD	Footnotes
1.2-Dichloroethane	ug/L	0	20	21.77	109	21.31	106	2	
cis-1,3-Dichloropropene	ug/L	0	20	21.60	108	20.88	104	3	
Trichloroethene	ug/L	0.1692	20	21.86	108	22.60	112	3	
1.2-Dichloropropane	ug/L	0	20	21.85	109	21.63	108	1	
Bromodichloromethane	ug/L	1.653	20	22.92	106	22.69	105	1	
Toluene	ug/L	0.2827	20	20.66	102	20.35	100	2	
1.1.2-Trichloroethane	ug/L	0	20	20.91	105	20.97	105	0	
trans-1,3-Dichloropropene	ug/L	0	20	20.36	102	20.22	101	1	
Tetrachloroethene	ug/L	0.2196	20	21.31	106	21.83	108	2	
Dibromochloromethane	ug/L	0.6354	20	21.39	104	20.93	102	2	
Chlorobenzene	ug/L	0	20	20.47	102	19.73	98.6	4	
Ethylbenzene	ug/L	0.1896	20	20.56	102	20.13	99.7	2	
Bromoform	ug/L	0	20	20.45	102	20.39	102	0	
1.1.2.2-Tetrachloroethane	ug/L	0	20	20.26	101	21.16	106	4	
Xylene (Total)	ug/L	0.9311	60	61.80	101	61.33	101	1	
' ichlorobenzene	ug/L	0	20	19.99	99.9	18.96	94.8	5	
ichlorobenzene	ug/L	0	20	19.88	99.4	18.76	93.8	6	
1.2-Dichlorobenzene	ug/L	0	20	19.99	99.9	18.99	95.0	5	
a.a.a·Trifluorotoluene (S)					95		101		
1.4-Dichlorobutane (S)					98		98		

LABORATORY CONTROL SAMPLE: 601	648108			
		Spike	LCS	Spike
Parameter	Units	Conc.	Result	# Rec Footnotes
	• • • • • • • • • • • • •		• • • • • • • • • • • • • • • • • • • •	••••
Chloromethane	ug/L	20	19.37	96.9
Vinyl Chloride	ug/L	20	19.85	99.3
Bromomethane	ug/L	20	22.82	114
Chloroethane	ug/L	20	23.64	118
Trichlorofluoromethane	ug/L	20	20.02	100
1,1-Dichloroethene	ug/L	20	21.28	106
Methylene Chloride	ug/L	20	23.98	120
trans-1,2-Dichloroethene	ug/L	20	21.50	107
1.1-Dichloroethane	ug/L	20	22.69	113
Chloroform	ug/L	20	22.73	114
1.1.1-Trichloroethane	ug/L	20	21.88	109
Carbon Tetrachloride	ug/L	20	21.29	106
Benzene	ug/L	20	20.48	102
1.2 Dichloroethane	ug/L	20	21.70	108
cir 1.3-Dichloropropene	ug/L	20	21.03	105

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

DATE: 12/29/97

PAGE: 31

Pace Project Number: 6019010 Client Project ID: Marco, KS

LABORATORY CONTROL SAMPLE:	601648108				
		Spike	LCS	Spike	
Parameter	Units	Conc.	Result	•	Footnotes
Trichloroethene	ug/L	20	21.52	108	
1.2-Dichloropropane	ug/L	20	22.06	110	
Bromodichloromethane	ug/L	20	21.55	108	
Toluene	ug/L	20	20.50	102	
1.1.2-Trichloroethane	ug/L	20	22.31	112	
trans-1,3-Dichloropropene	ug/L	20	20.81	104	
Tetrachloroethene	ug/L	20	21.83	109	
Dibromochloromethane	ug/L	20	21.61	108	
Chlorobenzene	ug/L	20	20.70	104	
Ethylbenzene	ug/L	20	20.59	103	
Bromoform	ug/L	20	20.89	104	
1.1.2.2-Tetrachloroethane	ug/L	20	21.92	110	
Xylene (Total)	ug/L	60	61.93	103	
1.3-Dichlorobenzene	ug/L	20	20.60	103	
1.4-Dichlorobenzene	ug/L	20	20.53	103	
: chlorobenzene	ug/L	20	20.91	105	
a.a.a.Trifluorotoluene (S)				96	
1.4-Dichlorobutane (S)				97	

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QUALITY CONTROL DATA

DATE: 12/29/97 PAGE: 32

GOLDER ASSOCIATES INC 200 UNION BOULEVARD

SUITE 500

LAKEWOOD, CO 80228

Pace Project Number: 6019010 Client Project ID: Marco, KS

Attn: Mr. RANDY MARCH Phone: (303)980-0540

QC Batch ID: 40165

QC Batch Method: 5030 Med Lvl Soil

601638471

Analysis Method: EPA 8021

Analysis Description: Halogen. & Aromatic Vol. Orgs.

Associated Pace Samples:

601638414

601638497

METHOD BLANK: 601652787 Associated Pace Samples:

Associated Face Suiples.	601638414	601638471 Method Blank	601638497	
Parameter	Units	Result	PRL	Footnotes
Critical commethane	ug/kg	530	20	
Vinyl Chloride	ug/kg	ND	46	
Bromomethane	ug/kg	ND	76	
Chloroethane	ug/kg	ND	130	
Trichlorofluoromethane	ug/kg	ND	130	
1.1-Dichloroethene	ug/kg	ND	34	
Methylene Chloride	ug/kg	ND	64	
trans-1,2-Dichloroethene	ug/kg	ND	26	
1.1-Dichloroethane	ug/kg	ND	18	
Chloroform	ug/kg	ND	13	
1.1.1-Trichloroethane	ug/kg	ND	13	
Carbon Tetrachloride	ug/kg	ND	30	
Benzene	ug/kg	ND	50	
1.2-Dichloroethane	ug/kg	ND	13	
cis-1,3-Dichloropropene	ug/kg	ND	86	
Trichloroethene	ug/kg	ND	30	
1.2-Dichloropropane	ug/kg	ND	13	
Bromodichloromethane	ug/kg	ND	26	
Toluene	ug/kg	ND	50	
1.1.2 Trichloroethane	ug/kg	ND	13	
trans-1,3-Dichloropropene	ug/kg	ND	15	
Tetrachloroethene	ug/kg	ND	13	
Dibromochloromethane	ug/kg	ND	24	
Chlorobenzene	ug/kg	ND	18	
E enzene	ug/kg	ND	50	

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QUALITY CONTROL DATA

DATE: 12/29/97 PAGE: 33

Pace Project Number: 6019010 Client Project ID: Marco, KS

METHOD BLANK: 601652787

Associated Pace Samples:

	601638414	601638471	601638497	
		Method		
		Blank		
Parameter	Units	Result	PRL	Footnotes
Bromoform	ug/kg	ND	50	
1.1.2.2-Tetrachloroethane	ug/kg	ND	13	
Xylene (Total)	ug/kg	ND	180	
1.3-Dichlorobenzene	ug/kg	ND	26	
1.4-Dichlorobenzene	ug/kg	ND	26	
1.2-Dichlorobenzene	ug/kg	ND	26	
Naphthalene	ug/kg	ND	130	
Methyl-tert-butyl Ether	ug/kg	ND	260	
Dichlorodifluoromethane	ug/kg	ND	70	
a.a.a-Trifluorotoluene (S)	*	85		
1.4-Dichlorobutane (S)	*	97		

M .X SPIKE & MATRIX SPIKE	DUPLICATE: 601	652795 60165	2803	Matrix		Matrix	Spike		
			Spike	Spike	Spike	Sp. Dup.	Dup		
Parameter	Units	601638414	Conc.	Result	# Rec	Result	≵ Rec	RPD	Footnotes
Chloromethane	ug/kg	399.4	498.3	1255	172	1366	194	12	3
Vinyl Chloride	ug/kg	6.067	498.3	343.8	67.8	330.6	65.0	4	
Bromomethane	ug/kg	15.92	498.3	69.99	10.9	71.46	11.1	2	
Chloroethane	ug/kg	0	498.3	363.3	72.9	379.5	76.0	4	
Trichlorofluoromethane	ug/kg	0	498.3	425.5	85.4	400.9	80.3	6	
1.1-Dichloroethene	ug/kg	2.671	498.3	467.9	93.4	440.9	87.7	6	
Methylene Chloride	ug/kg	43.42	498.3	531.6	98.0	519.4	95.3	3	
trans-1.2-Dichloroethene	ug/kg	2.635	498.3	479.6	95.7	451.5	89.9	6	
1.1-Dichloroethane	ug/kg	0	498.3	512.0	103	485.7	97.2	6	
Chloroform	ug/kg	4.392	498.3	516.2	103	500.2	99.3	3	
1.1.1 Trichloroethane	ug/kg	0	498.3	516.5	104	486.9	97.5	6	
Carbon Tetrachloride	ug/kg	2.524	498.3	482.7	96.4	450.2	89.6	7	
Benzene	ug/kg	0	498.3	492.3	98.8	472.0	94.5	4	
1.2-Dichloroethane	ug/kg	2.766	498.3	481.2	96.0	488.9	97.3	1	
cis-1,3-Dichloropropene	ug/kg	1.833	498.3	526.3	105	519.6	104	2	
Trichloroethene	ug/kg	4.144	498.3	547.2	109	528.1	105	4	
1.2-Dichloropropane	ug/kg	0	498.3	526.0	106	527.3	106	0	
Bromodichloromethane	ug/kg	0	498.3	497.0	99.8	487.8	97.7	2	
Toluene	ug/kg	0	498.3	521.7	105	501.9	100	4	
1.1.2-Trichloroethane	ug/kg	3.097	498.3	525.8	105	530.2	106	1	
tr 1.3-Dichloropropene	ug/kg	2.324	498.3	528.0	106	515.5	103	3	

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QUALITY CONTROL DATA

DATE: 12/29/97 PAGE: 34

Pace Project Number: 6019010 Client Project ID: Marco, KS

MATRIX SPIKE & MATRIX SPIKE	DUPLICATE: 60	1652795 60165	2803	Matrix		Matrix	Spike		
			Spike	Spike	Spike	Sp. Dup.	Dup		
Parameter	Units	601638414	Conc.	Result	≵ Rec	Result	≵ Rec	RPD	Footnotes
Tetrachloroethene	ug/kg	5.443	498.3	549.9	109	538.7	107	2	
Dibromochloromethane	ug/kg	0	498.3	498.5	100	493.7	98.8	1	
Chlorobenzene	ug/kg	0	498.3	529.7	106	519.6	104	2	
Ethylbenzene	ug/kg	0	498.3	536.2	108	515.3	103	4	
Bromoform	ug/kg	0	498.3	474.9	95.3	471.8	94.5	1	
1.1.2.2-Tetrachloroethane	ug/kg	0	498.3	525.4	105	526.7	105	0	
(ylene (Total)	ug/kg	11.05	1495	1617	107	1553	103	4	
1,3-Dichlorobenzene	ug/kg	4.639	498.3	528.6	105	523.7	104	1	
1,4-Dichlorobenzene	ug/kg	6.614	498.3	523.6	104	524.4	104	0	
1.2-Dichlorobenzene	ug/kg	5.772	498.3	516.7	102	521.9	103	1	
a.a.a-Trifluorotoluene (S)					90		88		
1.4-Dichlorobutane (S)					98		100		

		Spike	LCS	Spike
Fulleter	Units		Result	# Rec Footnote
Chloromethane	ug/kg			
Vinyl Chloride	ug/kg	500	345.1	69.0
Bromomethane	ug/kg	500	148.4	29.7
Chloroethane	ug/kg	500	539.4	108
Trichlorofluoromethane	ug/kg	500	461.5	92.3
1.1-Dichloroethene	ug/kg	500	506.0	101
Methylene Chloride	ug/kg	500	604.3	121
trans-1,2-Dichloroethene	ug/kg	500	534.7	107
1.1-Dichloroethane	ug/kg	500	576.0	115
Chloroform	ug/kg	500	590.7	118
1.1.1 Trichloroethane	ug/kg	500	602.0	120
Carbon Tetrachloride	ug/kg	500	523.0	105
Benzene	ug/kg	500	515.3	103
1.2-Dichloroethane	ug/kg	500	548.8	110
cis-1,3-Dichloropropene	ug/kg	500	524.2	105
Trichloroethene	ug/kg	500	583.1	117
1.2-Dichloropropane	ug/kg	500	565.9	113
Bromodichloromethane	ug/kg	500	524.1	105
Toluene	ug/kg	500	526.8	105
1,1,2-Trichloroethane	ug/kg	500	562.3	112
trans-1,3-Dichloropropene	ug/kg	500	496.4	99.3
Tetrachloroethene	ug/kg	500	582.7	117
or mochloromethane	ug/kg	500	500.6	100

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

DATE: 12/29/97

PAGE: 35

Pace Project Number: 6019010 Client Project ID: Marco, KS

LABORATORY CONTROL SAMPLE: 60	1652811				
		Spike	LCS	Spike	
Parameter	Units	Conc.	Result	* Rec Footnotes	
Chlorobenzene	ug/kg	500	520.4	104	
Ethylbenzene	ug/kg	500	533.2	107	
Bromoform	ug/kg	500	478.9	95.8	
1.1.2.2-Tetrachloroethane	ug/kg	500	550.3	110	
Xylene (Total)	ug/kg	1500	1578	105	
1.3 Dichlorobenzene	ug/kg	500	492.1	98.4	
1.4-Dichlorobenzene	ug/kg	500	485.4	97.1	
1.2-Dichlorobenzene	ug/kg	500	486.8	97.4	
a,a,a-Trifluorotoluene (S)				104	
1.4-Dichlorobutane (S)				98	

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DATE: 12/29/97 PAGE: 36

Pace Project Number: 6019010

Client Project ID: Marco, KS

QUALITY CONTROL DATA PARAMETER FOOTNOTES

Consistent with EPA guidelines unrounded concentrations are displayed and have been used to calculate & Rec and RPD values.

ND Not Detected NC Not Calculable

PRL Pace Reporting Limit

RPD Relative Percent Difference

Surrogate **(S)**

[1] The calculated RPD was outside QC acceptance limits.

[2] The calculated RPD was outside QC acceptance limits.

[3] Spiked sample recovery is not within control limits.

REPORT OF LABORATORY ANALYSIS

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Pace Analytical

CHAIN-OF-CUSTODY RECORD Analytical Request TIME 됩 CHORNO REMARKS DATE Samples Intact: Y / N **ACCEPTED BY / AFFILIATION** Requested Due Date: Pace Project Manager Pace Project No. Pace Client No. Sealed Cooler: Y / N 1 2 Weeks SAMPLE CONDITION 1 Week 2 Wee TIME 24 Hours Turn around Time ☐ 3-5 Days HEN AFLINGUISHED BY / AFFILIATION DATE **N** / ≻ ANALYSES REQUEST Received on Ice: • 11 100 Na₂S₂O₃ サインドー PRESERVATIVES HOBN ပ N VOA (HCL) HNO³ P.O. # / Billing Reference *OSZH NE DUPPESERVED *** × · Project Name / No. NO. OF CONTAINERS 60 1638471 103430 Report To: TIME MATRIX PACE NO. Bill To: SHIPMENT METHOD ; .7 3: 1.. OUTDATE 1 · -Date Sampled • SAMPLE DESCRIPTION 1. ì • Additional Comments Sampled By (PRINT) COOLER NOS Sampler Signature Address Phone ITEM NO. Client 9 æ က 2 / α 4

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